SCIENTIFIC AMERICAN

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THE FIRMENICH SAFETY STEAM BOILER.

The annexed engraving represents the Firmenich safety boiler, which is claimed to contain a number of important advantages, and which, according to records of actual tests at the Centennial Exposition and elsewhere, has given successful results.

In Fig. 2 are illustrated the essential portions of a seventy-five horse power boiler of this type, from which the general method of construction will be understood. The mud drums, A, are connected by systems of slightly inclined tubes with the steam and water drums, B B. Through the space left between the tube section, at C, the bridge wall rises, and its effect is to cause the gases of combustion to take a course from the fire box upward over this wall, and then downward in the rear compartment, escaping through the smoke box into the chimney. The mud drums, heating tubes, and lower half of drums, B B, are filled with water, which is thus distributed over a large number of small spaces, the object of which is the heat resulting from combustion.

In Fig. 1 we represent two 150 horse power boilers of this system as put up for the Niagara Starch Works, of Buffalo. In the SCIENTIFIC AMERICAN of January 27, 1877, we represented this boiler incased in brickwork; it is now incased in a sheet iron jacket, as shown. This is stated to be cheaper and to occupy less room than the massive brickwork. A layer of brick is first placed around the boiler proper, and the space between this and the jacket is filled with ashes or other non-conductor.

In the large boilers there are two steam and water drums, and one steam drum above the tubes; in smaller ones of 50 horse power and below, only one drum is used. The lower or mud drums vary in diameter from 12 to 24 inches, and the upper ones from 27 to 40 inches, and in length from 6 to 18 feet, according to the capacity of the boiler. The heating tubes are from 2 to 3 inches in diameter, and from 3 to 16 feet long, arranged in two or three rows, expanded in the mud drums and water drums in the usual way. Large manholes are provided in all the drums to admit of easy access to the interior of the boiler.

Among the advantages claimed by the manufacturers are chiefly safety and economy. The boiler is made up entirely of tubes and small drums, to secure strength. It will also be observed that no part of the boiler is exposed to the intense heat of a smal. furnace, and that the furnace really constitutes the whole of the boiler, the heat being diffused over an exceedingly large surface, with the object of obtaining equality of expansion. The water tubes, in short, constitute the sides of the furnace. A perfect circulation is claimed to exist; a downward current taking place in those tubes most remote from the source of heat, causing the greater part of the scale to drop in the mud drums, from which it can be conveniently removed. As regards economy the Firmenich boiler, at the Centennial Exposition, produced, we are informed, the hottest and greatest quantity of steam per pound of anthracite coal. The cause of this economy the manufacturers state to be the large fire chamber, where more perfect combustion is secured than usual by giving ample room for the gases issuing from the coals to intermingle with the atmosphere. Their combustion is not arrested by coming in contact with the relatively cold surface of the boiler containing water. The temperature of a boiler furnace is about 2,000° Fah., while that of steam and water at 70 pounds pressure is but 316°.

Fig. 2

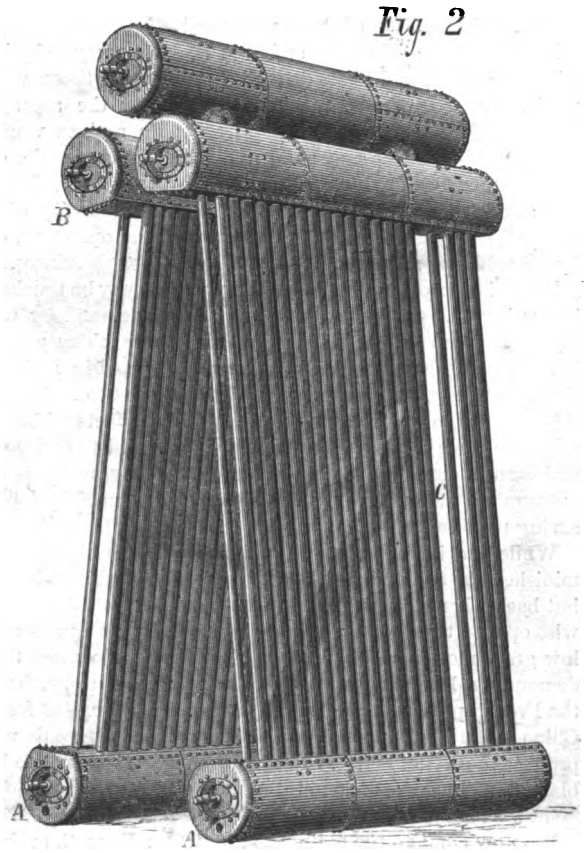

Fig. 2.—THE FIRMENICH SAFETY STEAM BOILER.

Through the room afforded combustion is effected before the gases reach the water surfaces. This the makers believe to be the very best arrangement for absorbing heat rapidly and properly, allowing perfect circulation of both steam and water, and never requiring cleaning from soot or ashes; the soot being actually consumed, and the ashes falling back on and through the grate into the ash pit. A large number of boilers of this description have been in use, we are informed, for years, and are never cleaned, making steam as well as on the day when first put up.

Although the Centennial test was made with anthracite coal, these boilers are especially designed for burning soft slack coal, as economy consists also in using cheap coal, a point of some importance when one costs 50 per cent more than the other.

For further information address the manufacturers, J. G. & F. Firmenich, 13 Mortimer street, Buffalo, N. Y.

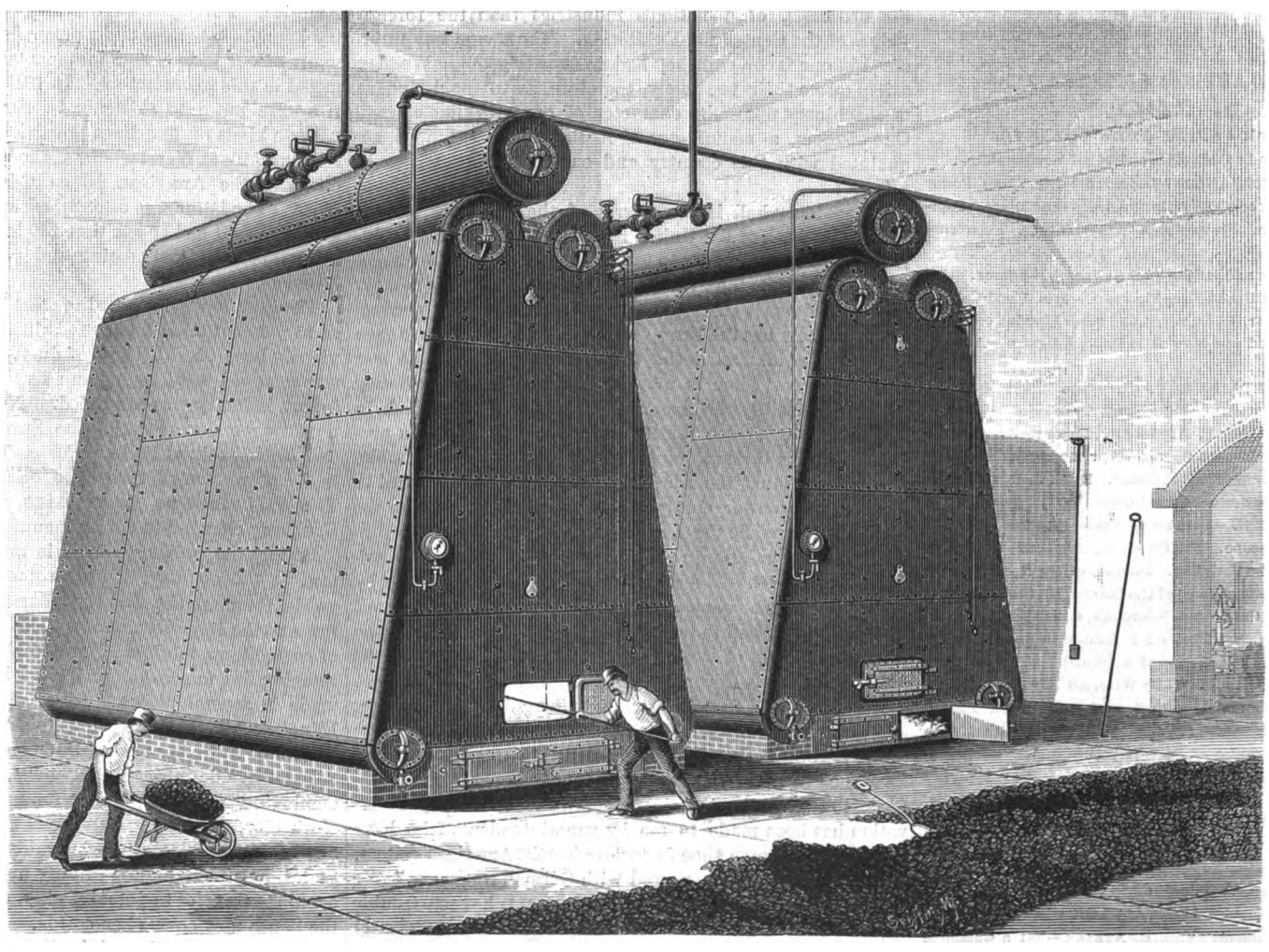

Fig. 1.—THE FIRMENICH SAFETY STEAM BOILER.

Turpentine as an External Application in Small-pox.

Dr. Farr, in a communication to the *Lancet*, states it as his opinion that body disinfection in the treatment of infectious fevers is not nearly so strictly observed by medical men as its importance demands, and calls attention to the great prophylactic value of rectified spirits of turpentine as an external application in small-pox. He states that it at once relieves any smarting or irritation, effectually corrects the unpleasant odor given off in the more confluent form of the disease, and seems in a marked degree to arrest pustulation, and so modifies to a great extent, and in some instances prevents entirely, pitting. Its powerful antiseptic and disinfectant properties, too, are indisputable; and in this it possesses an additional advantage in preventing the spread of the infection. He used it with great success in the epidemic of 1871–2; and since then it has been used with most satisfactory results by others. It should be applied every night and morning by means of a feather, in the proportion of one part of the turpentine to four of olive oil. Dr. Farr believes that if this plan of antiseptic inunction were carried out in all cases, the mortality from that loathsome and dreaded disease, small-pox, would be considerably reduced, and its ravages proportionately checked.

The Virginia Gold Mines.

Mr. J. E. Emerson, a valued correspondent of this journal, who has recently visited the Spottsylvania (Va.) gold mines, sends us a communication calling attention to the necessity of some improved process for saving the fine gold which is covered or incased with iron. As in this condition it cannot be amalgamated it goes to waste and only the coarse gold is saved. Mr. Emerson says he was at an abandoned quartz mill where thousands of tons of quartz tailings remain, and by washing down a sample of this, heating it, treating with sulphuric acid, amalgamating the residue, he obtained a fine specimen of amalgam gold. The miners are now sluicing off the surface in California style and are taking sufficient gold to pay. One lump of pure metal weighing 100 pennyweights was recently found.

A narrow gauge railroad runs within three miles of where the principal mines are now being worked about 20 miles in a westerly direction from Fredericksburg. The gold belt is the continuation of the North Carolina one, and covers a vast region of country. It also contains other valuable minerals, consisting of beds of iron ore and copper, lead, and other sulphurets in superabundance.

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MIND, MUSCLE, AND MACHINERY.

Speaking of the influence of machinery upon the artisan, an intelligent professional man said to us the other day: "It stands to reason that a man who operates a machine for polishing boot heels, for instance, must by the very nature of his occupation be less intelligent than the man who sits at the bench and makes a whole shoe."

Our friend merely expressed in a pointed way what many feel, namely, that the more nearly automatic machinery is, the greater its effect in subordinating the man to the machine; the more it tends to depress the value of mind and manual skill, and so lower the intellectual grade of the operator.

Where so many elements enter the problem—elements whose value and bearing it is difficult if not impossible to estimate—it is no easy matter to pick out one, and say positively how much of a man's industrial condition and mental character is due to it. Indeed, it is quite useless to attempt the solution of such a problem as this by the study of individual cases. Only by considering the relative conditions of masses of men is it possible to arrive at any just conclusion as to the influence of a factor like machinery upon the intellectual condition of those who use it.

Machinery can affect the artisan class in two ways—by its selective action, and by its direct influence upon those who use it. In other words, machinery may alter the average intellectual grade of the men required to do a given work, by demanding on the one hand a higher average grade, or on the other by allowing the work to be done by less capable men; and it may less directly affect the membership of a trade either by dulling the intelligence of the operative, or by schooling him to greater alertness and thoughtfulness.

There is one phase of this question which may be touched in passing, and that is the vastly increased demand for the highest grades of skilled labor in making the machinery used in our shops, and in making the machines used in making that machinery. Trustworthy statistics are not to be had in this connection; yet we are confident that the facts will bear us out in the assertion that the skilled machinists and tool makers now employed in the occupations we have mentioned, outnumber many times the skilled men displaced by labor saving machinery.

While the introduction of machinery has in no wise diminished the demand for the higher grades of skilled labor, but has rather increased it, we must admit that it has likewise opened the door for a large increase in the number of low grade men in mechanical employments. To meet this demand we have imported men largely from Europe, from the French provinces of Canada, and to a small extent from China. The wisdom or folly of these importations we do not propose to discuss here. In any case machinery is not to be blamed, so long as it has not diminished high grade employment for men of native birth.

We now come to the main point at issue: Does the using of machinery dull the intellect? Does the machine user lose his manliness in proportion to the perfection of the machine, allow his skill of hand and acuteness of sense to die away, and, becoming, as it were, a part of a machine, sink to the level of brute matter? We have heard this charge laid at the door of machinery time and again by people by no means unintelligent. It is one of the current fallacies of the labor question.

We doubt if there was ever a keener or more intelligent body of critics ever set to judge the results, and indirectly the processes, of a nation's industries than the foreign judges of the Centennial Exhibition. They were not prejudiced in our favor, and they had no axes to grind. We may safely quote their testimony, therefore, as to the influence of machinery upon the character of our working classes. One of them, a manufacturer of the first rank, well acquainted with this country and our industries, writes as follows:

"Machinery hall is the mirror of the processes and of fabrication both of the United States and of the Old World. But this mirror presents to the European a painful image. He learns too late the truth of the maxim that time is money, and consequently the importance of machinery in production. Scarcely has the European who goes to America to earn his bread put his foot in the country when already his star cries to him, 'Time is money;' for he sees immediately with what facility the American works, and how much in this respect he himself remains behind. The American produces twice or thrice as much as he, and with less trouble. The reason is that the European works as he has learned to do, that the master continually teaches his apprentice the same routine, while the American seeks unceasingly to simplify the manipulation, to invent, and to apply every possible improvement. The first thing which must be done by the European who comes to work in America is to break off the old routine, and to seek, while practicing himself in the American system of work, to acquire that which neither the good schools of Europe nor his former experience have taught him," and that, in brief, is to be quick, wide awake, and exact in his work. Further on the same observer says:

"My workmen also work with American machines. They have the same tools, but their productive capacity is far inferior to that of the American operative. The same observation has been made to me by superintendents who have established German shoe factories after the American system, and who often cannot succeed with German workmen." We may note here that American manufacturers have no trouble with German shoemakers—after they have been sufficiently educated by the use of machinery.

Again we read: "I am satisfied from my knowledge that no people has made, in so short a time, so many useful inventions as the Americans; and if to-day machinery apparently does all the work, it by no means reduces the workman to a machine. He uses it as a machine, it is true, but he is always thinking about some improvement to introduce into it, and often his thoughts lead to fine inventions or useful improvements." The chief reason for the tendency of the American workman's mind to run in the direction of invention is very properly found in the inducements held out by a liberal patent law.

A manufacturer of even wider experience, in France as well as in Switzerland, observes that "the use of new and admirable automatic machinery has revolutionized every kind of manufacture, by dispensing more and more with hand labor; but we must not forget that to manage these machines, to adjust them, to get out of them all that can be got, requires workmen better and better taught, careful, experienced, and steady." Subsequently, after referring to the Swiss commissioner's report with regard to the superior intelligence and productive power of American machine users, the writer goes on to say:

"We have constantly made the same observation in our own machine shops. Whenever we compare the work of two mechanics of unequal skill, both using automatic mechanism or performing the same work by hand, we always find the relative excess of production of the more skillful workman over that of the other much greater in the first case than in the second. Manual labor when it is irksome and monotonous dulls the mind. But when a workman who possesses the spirit of order, some training, and the elementary principles of geometry and mechanics, has charge of an automatic machine his mind cannot be at rest. When his machine is in operation, he profits by his leisure to examine the work which it has performed. He detects and remedies the causes which make it irregular; he keeps the detached parts of the machine in order, and the whole well regulated. Thus he avoids waste and interruptions." And in doing all this he necessarily raises himself in the scale of intelligence.

One line of testimony of this sort is worth any amount of guesswork from those who lack practical experience with men and machinery, no matter how learned they may be in other directions. No machine can put brains into a mechanic's skull. The most perfect piece of automatic mechanism cannot educate a natural born fool. But if a man has any brains, if he has any desire to improve himself, the management of a machine, even for polishing boot heels, will leave his mind as open to thought, as free to improve itself, as the best equipped cobbler's bench in the world. One great obstacle to the introduction of improved machinery has always been the circumstance that the average workman has seldom been intelligent enough to use such machinery at once to advantage. How much has the sewing machine done to give an idea of mechanics to our women! To be a successful farmer now, one has almost to take a course in practical mechanics, in order to be able to handle his machinery properly. So it is more or less largely in every department of labor. Machinery has compelled the better education not only of mechanics, but of everybody.

A NEGLECTED INDUSTRY.

A new field awaiting the employment of an immense amount of labor, capital, and inventive talent now exists ready at hand in the neglected flax and linen industry of America. Forty years ago nearly every farmer in the country knew how to raise and prepare flax for domestic use, and many of our fathers and mothers were to some extent engaged in this manufacture. In 1845–55 several manufactories were put into existence in New England to make the various kinds of fine linen goods. Among these were the Stevens mills at Webster, Mass., the Willimantic, in Connecticut, and the American Linen Company, of Fall River, Mass. The latter was established in 1852 with a capital of $500,000, and had at one time 250 looms running upon sheeting, table linen, and coating and pantalooning, besides the coarser kinds of fabrics.

These mills were enabled to start by the placing of a duty of 25 per cent upon linen goods in 1842, while they had previously been admitted free of duty. But in 1857 the duty was removed and linen again admitted free of duty, and the infant industry was strangled. Nothing of the old industry now remains excepting the Stevens mills, making crash and huckaback, at Webster, Mass. These mills are no longer in the possession of those who originally established them. The Willimantic no longer exists, and the American Linen Company changed to cotton manufacture long ago.

Besides the Stevens, which is much the most extensive mill in the country, making some fifteen kinds of coarse goods, there are the Stark, at Manchester, N. H., the Ludlow and the Bay State, in Massachusetts, all small producers of coarse linen fabrics. These, we believe, are the only mills weaving flax fabrics in the United States. Tow bagging is made in several places in Ohio, Indiana, Louisville, and in Illinois, while the initial steps toward the establishment of a linen mill have been taken in Oregon.

Extensive flax thread mills exist, one at Paterson, N. J., employing 500 hands; one at Troy, N. Y.; and one in New York city, employing 600 hands. Up to 1872 there were nearly a hundred flax bagging mills in the central Western States, but the reduction of duty upon jute caused an almost complete transfer to jute bagging, the material with which the South now covers her cotton.

This is the condition of the linen industry in the United States at this time. Of the raw flax used by the crash and

thread mills, 4,000 tons are imported and 1,000 tons are home grown, chiefly from the northeastern portion of the State of New York. A considerable portion of the imported is Russian, a part, that of the best, is Belgian, a part Canadian, and some Irish. The use of American flax is for the most part to adulterate the better imported kinds, and thus lessen the cost of the product. There is a general complaint that the American fiber is less skillfully cared for, and carelessly cured and prepared, and certainly its value, 9 cents a pound, indicates that either too little attention is given to the growth of the flax or to the preparation of the fiber. The imported flax fiber, simply separated from the coarse stalk and with the tow still in it, and not of a fine quality, has a value of 12 and 15 cents per pound in Belgian and Russian ports. Upon this there is still an additional cost of 30 per cent duty, besides cost of transportation, making the cost of a good quality of Belgian flax at this port nearly 20 cents a pound. But *little* of this is used, and that to give a better finish, a longer and stronger fiber to thread, but is largely adulterated with the cheaper Canadian, Russian, and American. The crash mills would use the American fiber altogether if its character could be depended upon; but from its careless manipulation and want of attention to growing and dressing it is of less value and more difficult to use.

What is required at this time is that our farmers attend to the requirements of fertilizers and the rotation of crops necessary to grow the fiber to perfection, and then sow the proper amount of seed, 2 to 3 bushels per acre, pull it before it is over-ripe, steep it, and spread it just long enough to separate the fiber completely, and the present demand for flax may be easily supplied at home.

This is the first step, and if it cannot be secured without the assistance of a flax association, such should be organized. The importation of raw flax is about 4,000 tons annually, at a cost of about $1,250,000, the importation of linseed about $6,000,000 annually, and of linen goods about $15,000,000 annually.

The value of the flax industry to Russia is above $100,000,000 annually, the exports of linen goods by England is upwards of $50,000,000 annually, while the number of looms in Great Britain in 1870 was 39,738, and in 1875, 51,601, having increased tenfold since 1850.

The establishment of a linen industry in America is not a work of a day, but the fact that the country has every requisite of the world for its successful establishment should incite our people to make the necessary effort. Much inventive skill would of necessity be called into action to supply labor-saving appliances, and considerable capital, labor, and patience would be required to obtain success. The government should be willing to accord it the same assistance, by way of a duty upon imported goods, which it afforded the silk industry, and with that there need be no risk of ultimate success.

A KEELY SEANCE.

Forty gentlemen, representing, as we are informed, a million dollars' worth of the stock of the Keely Motor Company, recently gathered at the Fifth Avenue Hotel, in this city, for the purpose of hearing a statement from Mr. Keely "as to the present condition and future prospects of the company." The proceedings began with a report from the board of directors to the effect that they were "convinced of the entire integrity of Mr. Keely, and ultimate success of the new motive power," but that the affairs of the concern were now at a standstill, owing to the funds having been exhausted eighteen months ago. The directors had personally contributed $9,000, and now called upon the stockholders to put in about $4,000 more, which, according to Mr. Keely, was all that was required to "carry the enterprise to a point of patenting and render it able financially to take care of itself." This address was not enthusiastically received.

Mr. Keely then remarked that after an elaborate research of two years he was now able to prove the practicability of his system. The difficulty had been in getting apparatus which would produce vibratory inductions. The system being now changed, all that was necessary was to intensify to get the vibratory inductions to produce power. Still it was an infinite success. It necessitated (*sic*) to carry undulatory action to intensify the undulative process to intensify the undulative force. He had demonstrated by rotating machine the action of vapor under vibratory rotation. Success had been encountered at every point. All that is needed now is a tube that will stand 25,000 pounds pressure. The volume of half a pint of water is more at vibratory induction than a gallon at undulatory process. The peculiar feature of the new machine is inducing operation without connecting the vibrating medium. The success had been triumphant. The motor is not microphonic or acoustic, and hence his investigations differed from those of "Mr. Ediphone," who did not work by globular transmission. Keely produced evolution by vibratory induction. The machine was strong enough for undulatory process for single reaction free of compound reaction, which is disadvantageous. By September 1st he would show the stockholders the "luminosity of the ether," and it followed that the moment scientists saw that they would be convinced. A pressure of 28,800 pounds had been maintained, and the motor was a great success.

Mr. Keely's remarks in this strain—and the sentences above given are quoted *verbatim*—continued for some twenty minutes. Although, as is obvious, they were nonsense, unalloyed by even the semblance of sense or logical connection, they were listened to with profound gravity, though toward the end a puzzled expression was generally apparent on the faces of the assembly.

The Secretary, Mr. C. H. Schuellermann, then began a series of appeals for funds. He said that if the $4,000 necessary was not subscribed the 124 shares of stock in the treasury, or else territory, would have to be sold. One half of the New England States, valued at $450,000, had only elicited a bid of $1,500. The motor was a grand success, and there was no doubt but that a 150 horse power machine would be going by September 1. He vigorously remonstrated against funds being raised by contributions of stock for resale. "Stock isn't money," he remarked. Finally he reached the true inwardness of the meeting by announcing that Mr. Keely's salary for nine months, $1,800, had not been paid; nor had the Secretary's—a like sum. This rather disheartened the stockholders, as it was not clear, if $3,600 were taken from the prospective $4,000 to pay Keely and the Secretary, how such expensive undulatory processes and vibratory inductions could be got for the remaining $400. There being a general repugnance to a subscription list, the stock contribution was finally agreed to, and the price of shares fixed at $20 each; but when we departed no eagerness was manifested to contribute stock, and there seemed to be a widespread aversion to buying any.

The Keely stockholders, so far from being ignorant or uneducated, are an apparently intelligent body of gentlemen, all belonging to the upper walks of life, and probably are as good a representative body of the business men of this city as could be collected. It is, therefore, all the more surprising that individuals of this stamp should be so lacking, not merely in special scientific knowledge, but in ordinary acumen, as to become the dupes of Keely. Yet they have undoubted faith in the deception as a business venture, and have invested large sums of money upon the chance of its ultimate success. Their reluctance to come forward in answer to the Secretary's appeals for them to "protect their property" with more cash, seems due to a dawning impression, not of the infeasibility of the scheme, but of the fact that it involves very much more disbursements than accords with Keely's previous glowing predictions.

AN INDUSTRIAL PARADOX.

Common sense is a capital guide—when it is properly educated; otherwise it is the basis of all delusions. The uninstructed common sense of mankind invariably avers that the world is flat; but, the Rev. Jasper to the contrary notwithstanding, we know that it isn't. The common sense of the working class, by no means the least intelligent part of the community, has invariably objected to the introduction of labor-doing machinery. To them the case is plain. If ten men are doing a certain kind of productive labor, and some one invents a machine wherewith one man can do as much as the ten have been doing, nine men must lose their job. Henceforth for them Othello's occupation's gone. That is common sense. But fortunately it is not common experience. Here comes in the industrial paradox: So far from the nine men going without work, the probability is rather that they will have more work to do, at higher wages, and ten other men will be called in to help them. That is the way labor-saving inventions usually work.

The common sense of English spinners told them that Arkwright's jenny would ruin their business; so they smashed it. The weavers did the same by Cartwright's loom. Yet these two inventions doubled the number not merely of English spinners and weavers, but the number of working Englishmen of all trades. The wealth of England as to a principal part of its trade and commerce is mainly their doing. The early commercial and industrial prosperity of our own country was very largely based upon cotton; but where would our cotton crop have been without Whitney's gin to clean it and Lowell's loom to weave it? The demand for American cotton was as nothing without the one, and could not be met without the other. By their great saving of labor they gave occupation to thousands, and cheapened the apparel of millions.

Quite as marked has been the influence of labor-saving machinery in the production of breadstuffs. But in estimating that influence it will not do to calculate how many men it would have taken to sow by hand and reap with a sickle the two thousand million bushels of grain we raised last year, and then say that the excess over the number of farm hands employed were so many men shut out from work by machinery. It is to labor-doing machinery that we owe the possibility of any crop at all in the larger part of the great grain producing regions of the interior. Without machinery to plow and sow and reap and carry the product to market, the inducement to open up the Western wilderness would have been as slight as the possibility of its execution. The West owes everything to machinery. In our great grain-producing States, in spite of—more correctly, in consequence of—the rapid introduction and improvement of agricultural machinery, the farmers and farm hands increased in number more than 50 per cent during the ten years ending 1860; and about 30 per cent during the next ten, notwithstanding the losses incident to war. This was 13 per cent more than their share of the gain of the entire population. Yet there never was a time when labor-saving machines were introduced more rapidly or in larger numbers.

But it may be said that this is not a fair illustration; a vast multitude of new farms were brought under cultivation during those twenty years, and these made the increase of farm hands possible. True, but the same effect was produced, in even greater ratio, in purely mechanical industries, where the displacement of manual labor was still greater. During the same years the increase in the number of hands employed in manufactories of all kinds more than doubled. Yet those were years of wonderful progress in the invention and improvement of machinery.

Again, it is objected that those were flush times, times of undue expansion in all directions, times of over-stimulation and over-production, and that we are suffering the consequences now. To a large extent true; but machinery was not to blame for that. If it were, manufacturing countries would be the worst sufferers now, which is not the case. Nor is it true that employments into which the largest proportion of labor saving inventions were introduced are now worse off than others. On the contrary, those are the employments best off to-day, the employments which show fewest men out of work. It is chiefly in those lines of manufacture in which new and improved machinery has so improved and cheapened the product as to exclude foreign competition and gain the world for a market, that business is most active to-day. Witness the shoe trade. Within twenty years invention has turned over to machinery not less than 85 per cent of the work, yet that machinery has made occupation for more men than it has displaced. By improving the quality and lessening the cost of shoes, in spite of a large increase in the cost of stock and the doubling of the wages paid to the factory hands, machinery has gained for American shoes a market wide as the world. As a natural consequence many more shops are required to meet the increased demand, more workmen are employed, higher wages are paid, and multitudes are furnished with new employment in tanning the additional leather required, in putting up and transporting the additional product, in making the machinery used, and in collateral branches of productive industry. Thanks to labor saving machinery our leather industries have been raised to the front rank, along with those of iron and cotton and flour; and from having other countries make our shoes the tables have been turned, and our people are employed by the thousand in making shoes for other nations. The same may be said of scores of useful products; and with many others there would be no possibility of their furnishing employment to any of our people were it not for our superior machinery. How, for instance, would it have been possible for us to compete with the hand looms of England and France in the weaving of carpets? Without power looms for this purpose we should have to import all our carpets; with the labor saving inventions of American mechanics, we make our own carpets, and so give employment to thousands of our own citizens. Only by means of inventions, which enable a few of our well paid men to do more and better work than many ill paid foreigners, is it possible for our industries to control our own markets, let alone those of other lands.

We hear it said that machinery subordinates mind and manual skill to brute matter, and so debases the worker; that men are made of less account thereby and wages depressed. Where is the proof? Where will one find the rates of wages higher, the working day shorter, the intelligence of the native working class greater, than here in America, where machinery is most used? And where in America is the artisan better off than in our manufacturing towns? The laboring classes have been distressed by hard times the world over of late years; the American workers, however, least of any; and of these, machine users have suffered far less than manual laborers. Trustworthy statistics could be given to prove the assertion made a moment ago, that the wages paid in shoe factories are now or lately were double what they were before machinery was introduced. For the sake of variety, take a less striking case. In the introduction to the American edition of the Swiss pamphlet "Look Out for Yourselves," the editor says that the books of a New England mill, which has employed from 350 to 450 hands for 45 years in the manufacture of the same grade of standard sheetings, show that the product per hand has more than doubled since 1835, and nearly doubled since 1855. Meantime, while the hours of labor have been lessened, the average daily pay of the operatives has increased since 1855 over 22 per cent for females and 46 per cent for males. This on the basis of even the low prices of January, 1878. Fortunately improvements in machinery have more than kept up with the increase in wages; and the relative cost of making cotton goods here compared with the cost in other countries is so low that we not only supply ourselves but are able to export, and thus secure employment for many that might otherwise have to go idle.

A volume of similar illustrations could be given if needed. The reverse would naturally be expected, but experience shows that instead of lessening the demand for labor, labor-saving machinery so called invariably increases the demand. The effect of machinery in compelling rapid readjustments of labor, and in crowding the incompetent and unimprovable to the wall, thereby intensifying the struggle for place, and the ultimate effect upon the intelligence and versatility of the artisan class, must be left for discussion hereafter.

Tennessee Steel Works.

The first open hearth steel ever made in the South was turned out June 6th by the Roane Iron and Steel Company of Chattanooga. The cast, an experimental one of six tons product, by the Siemens-Martin process, was a perfect success in quality. Specular ore from near Cartersville, Ga., was used. When in full operation the company expect to produce 150 tons a day.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, June 22, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Venus rises	2 17 mo.	Saturn rises	0 08 mo.
Mars sets	9 25 eve.	Uranus sets	10 40 eve.
Jupiter rises	9 43 eve.	Neptune rises	1 41 mo.
Jupiter in meridian	2 38 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	10 06 eve.	Regulus sets	10 41 eve.
Algol (var.) rises	11 46 eve.	Spica in meridian	7 15 eve.
7 stars (Pleiades) rises	2 10 mo.	Arcturus in meridian	8 06 eve.
Aldebaran rises	3 29 mo.	Antares in meridian	10 17 eve.
Capella sets	9 12 eve.	Vega in meridian	0 32 mo.
Rigel rises	5 36 mo.	Altair in meridian	1 44 mo.
Betelgeuse sets	6 10 eve.	Deneb in meridian	2 36 mo.
Sirius sets	5 37 eve.	Fomalhaut rises	0 50 mo.
Procyon sets	7 46 eve.		

REMARKS.

Saturn arrives at western quadrature June 24, after which time he will set before midnight, and therefore be an evening star; near the moon June 22, being nearly 7° south. Venus is near the moon June 27, being about 7° south. She is about 10° southwest of the Pleiades, and will soon pass between that cluster and the Hyades.

Mars is in *Cancer*, and with the *Northern* and *Southern Aselli* (δ and γ *Cancri*) forms a neat equilateral triangle, the sides being about 4°. In the center of this triangle the naked eye may discern a rich cluster of stars, mostly of the sixth magnitude, called *Præsepe*. Algol at minima June 26, 4h. 16m. morning, and 29, 1h. 5m. morning.

PENN YAN, N. Y., Saturday June 29, 1878.

PLANETS.

	H.M.		H.M.
Venus rises	2 12 mo.	Saturn rises	11 43 eve.
Mars sets	9 12 eve.	Uranus sets	10 12 eve.
Jupiter rises	9 18 eve.	Neptune rises	1 14 mo.
Jupiter in meridian	2 03 mo.		

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	9 39 eve.	Regulus sets	10 14 eve.
Algol (var.) rises	11 19 eve.	Spica in meridian	6 47 eve.
7 stars (Pleiades) rises	1 42 mo.	Arcturus in meridian	7 38 eve.
Aldebaran rises	3 03 mo.	Antares in meridian	9 50 eve.
Capella sets	8 45 eve.	Vega in meridian	0 04 mo.
Rigel rises	5 08 mo.	Altair in meridian	1 16 mo.
Betelgeuse sets	5 43 eve.	Deneb in meridian	2 08 mo.
Sirius sets	5 09 eve.	Fomalhaut rises	0 23 mo.
Procyon sets	7 20 eve.		

REMARKS.

The earth is farthest from the sun July 2. Mars still illumines the western sky, and is near the moon July 2, being about ½° north. Saturn will soon rise at a more seasonable hour in the evening. His rings may be seen to a better advantage at present than at any other time during the present year, the earth being about 5° above their plane.

Algol will be at minimum brilliancy July 1, 9h. 54m. evening, about one hour before rising; and as the increase in brilliancy occupies 3h. 20m., it will continue to get brighter for about two hours after rising.

How a Distinguished Scientist Raises Strawberries.

Some of the largest and finest flavored strawberries that we have seen this season were from the garden of our valued contributor, Alfred M. Mayer, South Orange, N. J. In forming new beds he invariably takes runners from new plants. Manures in the early spring. After the berries have formed he cuts off all runners and thins out the central leaves. Result: enlargement of the berry; improvement in flavor.

Lightning Conductors and Earth Contact.

The importance of a perfect earth contact for lightning conductors is shown by an accident at Nottingham, England, in 1868, which is mentioned by Dr. R. G. Mann, in the *Journal of the Society of Arts*. A copper lightning conductor, four tenths of an inch in diameter, was attached to the weathercock, one hundred and fifty feet from the ground upon the spire of a new church, and was carried in an unbroken line to the ground, and probably at first had a good earth contact; but after the accident an investigation showed that some thief had drawn it out of the ground and carried away all that was more than six inches below the surface.

On October 16, 1868, the church was struck by lightning, the fluid passing quietly until within about six feet of the ground. Had there been a good earth contact, all would have gone well, but at this point it was drawn from the conductor to a gas pipe on the inside of the wall, although separated from it by 4½ feet of solid masonry. The lightning then passed along the pipes to the gas mains and off into moist ground; but on its passage it totally destroyed a short piece of pipe near the gas meter and allowed the gas to escape, which, by the way, caused another accident on the following day, when a lighted lamp was carried into the cellar by the person sent to look up the leak. At the point where the electric fluid passed through the wall from the conductor to the gas pipe, the stone work was splintered into fragments through an area of about a square yard on either face of the wall, while the center of the wall, for a thickness of about a foot, was entirely uninjured.

FIRE TELEGRAPHS IN GERMANY.

The principle on which good fire telegraphs are based is that of establishing in sufficient numbers, and in easily accessible places, suitable apparatus by which the outbreak of a fire may be communicated by any person to the nearest fire engine and police stations, or to a central station, from where immediate orders are issued. Various methods may be adopted in order to obtain this result; but that which experience shows to be the most satisfactory, and which has best stood the test of time thus far, is the automatic system in use at many towns where a system of fire telegraphs has been established. By means of the automatic apparatus a certain sign may be telegraphed to the central stations indicating the street and district from which the alarm of fire was sent. It is evident that by sufficient distribution of this automatic apparatus over a town the time required for the dispatch of the brigade must be considerably shortened, thus allowing the fire to be attacked when in its infancy.

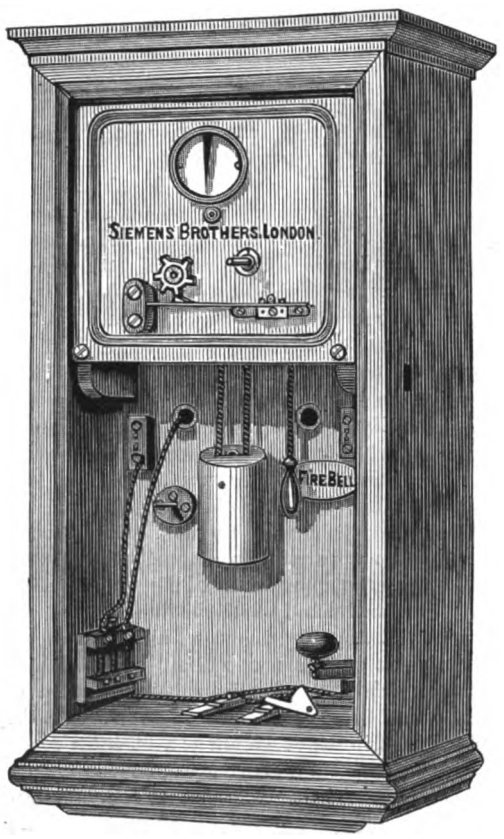


Fig. 1.—AUTOMATIC FIRE ANNUNCIATOR.

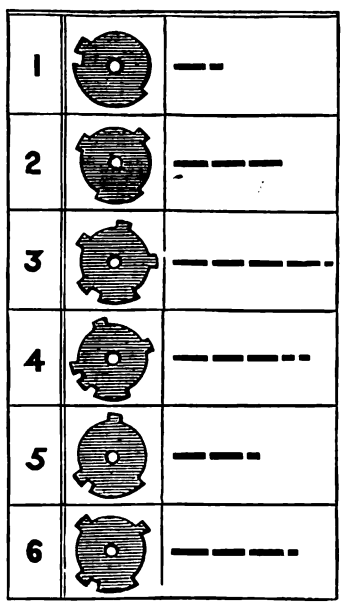


Fig. 2.—CONTACT WHEELS AND SIGNALS.

Mr. R. von Fischer Treunfeld, F.R.S., has recently read before the Society of Telegraph Engineers a valuable paper on this subject, the illustrations of which here given we take from *Iron*. Among other facts he states that in London, although there exists in that city a very efficient fire brigade, but no automatic system of fire telegraph, the proportion of serious fires reaches 10 per cent of the aggregate of all conflagrations; whereas in Berlin, where the fire department is not so well organized, but where an automatic telegraph system does obtain, the proportion is but 2·8 per cent. This difference he attributes to the fire telegraph used in the German cities, an account of which, as located in Hamburg, he gives as follows:

Hamburg possesses two central stations, the central fire brigade station and the central police station. Both stations are connected to seven district lines, which run radially from these centers to the suburbs, each line being connected with a number of fire brigade and police stations, as well as automatic fire annunciators. The chief object of these seven lines, with their annunciators, and fire brigade and police stations, is to send immediate notice to the brigade stations from the locality wherein the fire is first discovered. Besides this, telegraphic communication can be maintained between the different stations (as well as from the annunciators to the central stations), so that the required assistance may be properly disposed of. In this system it will be observed that all fires are first announced to the central station, and that all arrangements for the suppression of every fire are made from this central station, which thus regulates and controls the entire system.

The automatic fire annunciator, Fig. 1, is a very simple mechanical contrivance, introduced into the telegraph line, through which circulates a permanent current from a battery established at the central station. The annunciator, when brought into action, breaks the circuit, and thus sends a certain signal to the central station. The breaking of the circuit is caused by the rotation of a contact wheel, Fig. 2, the periphery of which is so shaped that the contact breaking corresponds to a certain Morse signal, and each signal to a certain district or street of the town. The annunciator is protected by a glass front, and is placed at street corners, in guard or railway stations, or in pillars situated in a prominent position, and where there is little likelihood of its being willfully damaged. On the discovery of a fire all that has to be done is to run to the nearest annunciator box, open or break the protecting glass, and pull the handle. The contact wheel then rotates, and the letter corresponding to the annunciator is transmitted several times in succession to the central fire brigade station, whence orders are telegraphed to the various engine and police stations.

There are, besides the two central stations, forty-seven Morse stations and fifty-three automatic annunciators, that is to say, 102 places from which the outbreak of a fire can be announced by telegraph. Both annunciators and Morse are connected to the same line, the former being situated at prominent places, as previously mentioned, the latter at fire brigade and police stations. The apparatus employed in the stations at Hamburg are Morse ink writers, with the usual complement of details. From the batteries, consisting of 850 Meidinger elements, fifty for each district line, a permanent current flows through the lines, all signals being made by breaking the circuit. The seven radial district lines all unite at the central fire brigade station, to which all fire alarms are first sent, and from which the requisite orders are immediately issued to the stations in the vicinity of the fire. By the different stations being thus connected together every facility is afforded to each station to give its help to the others as circumstances may require.

The telegraph lines are preferably underground, and consist of 151,631 feet of underground cable and 126,641 feet of overground line, the latter in the suburbs of the town only.

The working of the system is as follows: All stations except the central have their Morse instruments cut out, and only a loud sounding alarm in circuit. A signal sent by any of the annunciators or Morse stations is recorded at the central station on a self-starting Morse, attached to that line. The central station, after receiving this signal, sends, by means of a magneto-inductor, the fire alarm to all the stations of the district, or, if need be, to all the stations of the seven districts simultaneously, by means of a commutator fixed for this purpose. The operator at each Morse station, by a slight pressure of his foot on a lever, brings his instrument into circuit, and by this means each station is ready to receive orders from the central station, to which the exact position of the fire has been previously made known. The arrangement is such that when the operator takes up his po-

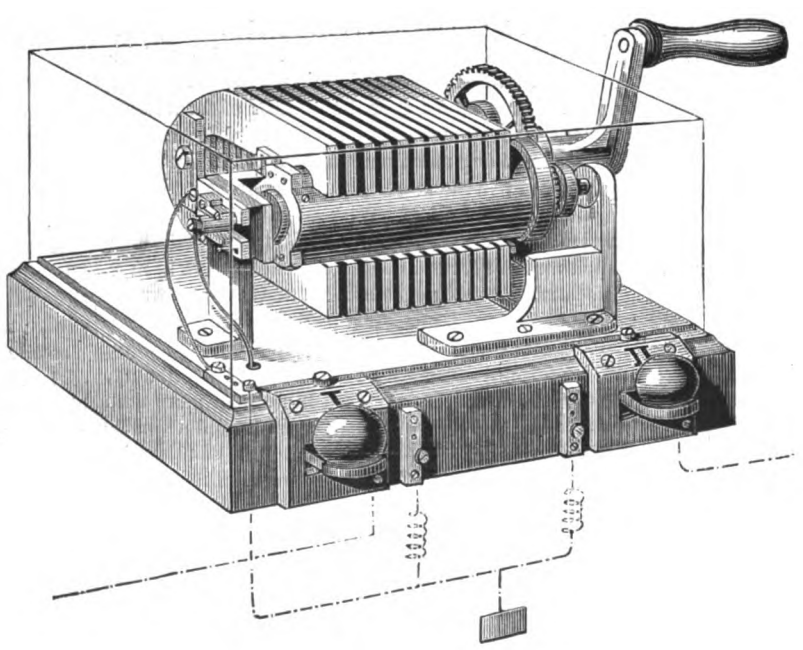


Fig. 3.—INSTRUMENT FOR TRANSMITTING ALARMS.

sition at the table the instrument is brought into circuit by means of the lever contact maker. As soon as he departs from this position the instrument is cut out of circuit. In this way there is no chance of delay or failure from forgetfulness on the part of the operator. The alarm signal is instantly followed by definite orders to the fire brigade and police stations nearest the fire. Having thus shown the arrangements and working of the radial system as in operation at Hamburg, the author explains the circular system of fire telegraphs, taking that in use at Amsterdam as an example.

The town is divided into three main circles (not including the suburban circle), the offices in each of which are in communication with the central station. Only fire brigade and police stations are in these main circles, and they are so connected that the police stations are situated in one half and the fire brigade stations in the other half of the circles. By this arrangement the two may be disconnected from each other, and enabled to communicate independently with their own central office. To each of the three main circuits a number of divisional circuits is attached, having their centers in one of the fire brigade stations. These divisional circles contain, as a rule, only automatic fire annunciators, although, as will be gathered from the diagram, this rule is not altogether absolute. The entire arrangement shows that there are 50 Morse apparatus and 185 annunciators in use. In all there are 159 places from which fire alarms may be given by telegraph. All the lines are worked on the closed-circuit system, the batteries of the Meidinger form being at the central station. The automatic annunciators have, besides the clockwork required for the movement of the contact wheel, a Morse key, a galvanoscope, and a lightning protector. By means of the key messages can be sent to the station of the division if required. The Morse apparatus in the stations is fixed in the same way as in the Hamburg system. In the central station is a magneto-inductor, by which the alarms of all stations may be rung, and, by an agreed combination of bell signals, either all or any single station may be called by the central station. The working of the system is similar to that in use at Hamburg. All stations, except the central, have their Morses "out" and their inductor bells "in." As soon as the central station receives a fire signal the alarm call is given by the magneto-inductor, and each station puts its Morse in circuit in the manner already described, to receive orders from the central station. The latter is provided with a special commutator by which any of the stations may be individually called by bell, or all sections simultaneously called together, and a message dispatched to all at the same time. The magneto-conductor is shown in Fig. 3. This inductor sends a series of alternating currents, giving the fire alarm, which is received on the station bells.

Fig. 4 shows a gong which is in use on the banks of the canals and rivers for the purpose of warning the fire boats moored in the channel; and Fig. 5 shows the detailed electrical arrangement which arrests and frees the spindle acting upon the hammer of the gong.

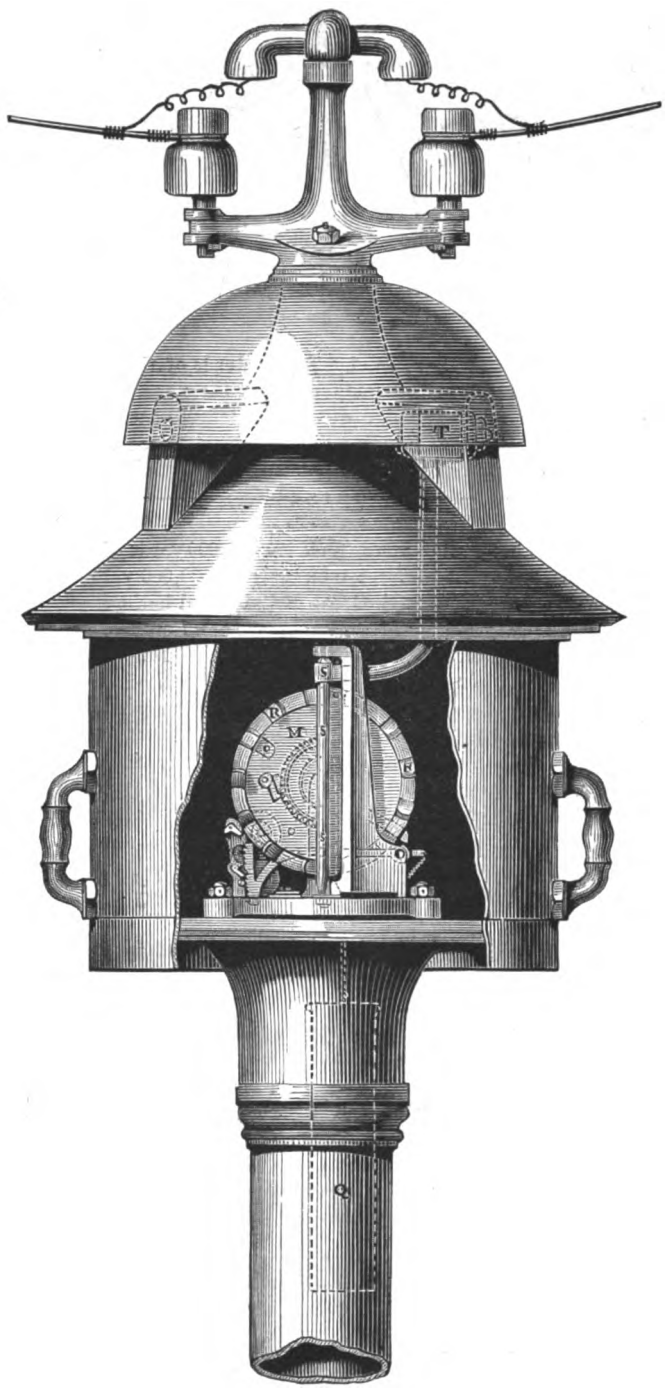


Fig. 4.—FIRE ALARM GONG.

Labor in England and Ireland.

The United States Consul at Birmingham reports that trade is very much depressed, partly owing to the diminution of exports to this country and the increase of imports hence. The better classes of mechanics receive about 17 cents an hour, or about $4.25 a week, an increase of 14 per cent over the rates paid five years ago. The increase in the cost of living has been small. The Consul at Londonderry reports that Irish farm laborers are getting about six dollars a month, with board and lodging. Lotters get 8 or 9 shillings a week, and day laborers from one to two shillings a day. A teamster may receive 15 shillings a week; and a factory girl, if steadily employed, as high as 7 shillings a week. Negotiations have been opened with American steamship companies for the return passage of English cotton operatives who have emigrated to this country and now want to get home again.

Anthracite Needed in Switzerland.

The United States Consul at Geneva reports that American anthracite might easily command the Swiss market. Wood is scarce and costs $18 a cord; coke brought from Lyons sells for $11 a ton; and a very poor oily coal is brought from Saarbrück. The Consul believes that anthracite could be introduced and sold for less than is now paid for inferior fuel, in which case it would be used almost exclusively. The matter is one which deserves attention.

A New Source of Lead Poisoning.

The occurrence of numerous cases of sickness among children, with symptoms of lead poisoning, has led to a remarkable discovery by the Imperial Health Office of Germany. It appears that the enameled cloth used in covering children's carriages is largely charged with lead, different specimens, of both German and foreign make, showing as high as 45 per cent of the metal. The fabric burned readily, and drops of the reduced metal were seen to fall even when a small piece of the cloth was ignited.

SHAD IN LAKE ONTARIO.—Seth Green's attempt to stock the waters of Lake Ontario with shad promises to be a success. The Ogdensburg *Journal* reports that the Oswegatchie river has lately been full of strange fish which experts pronounce to be genuine shad. They measure from six to seven and half inches in length.

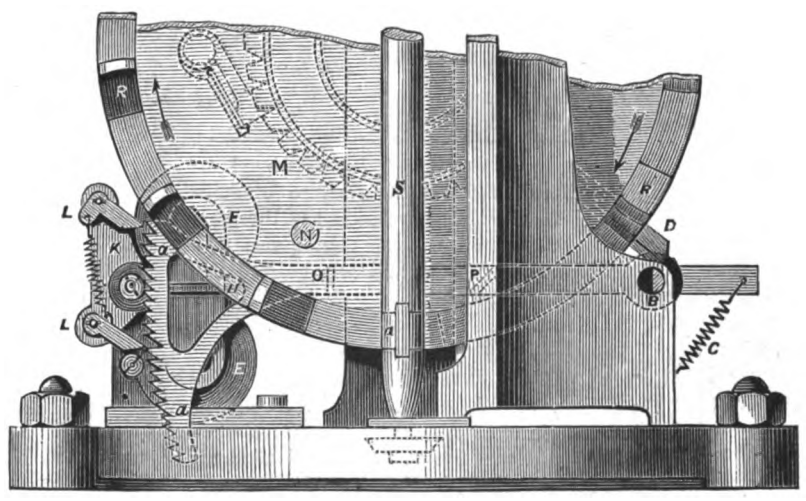


Fig. 5.—MECHANISM OF FIRE GONG.

New Mechanical Inventions.

A novel Dental Engine, invented by J. M. Stebbins, D.D.S., of New York city, is operated by an electric engine whose motion and power are controlled by a series of resistance coils, any number of which may be placed in the circuit. There are also improvements in the air forcing apparatus and in the mechanism for operating the burrs and pluggers.

Mr. John Collom, of Golden, Col., has invented a new Ore Separator, for which important advantages are claimed. It is of the "wet" type, and separates the ore by agitation over screens, placed just above the water level in a tank, motion being communicated to the water by means of suitable intermittent plungers. The tank is divided into compartments provided with screens of different mesh, so as to treat ores of varying fineness simultaneously.

An improved Former for Making the Truck Sides of freight cars has been patented by Messrs. R. H. Briggs and J. H. Dougherty, of Whistler, Ala. It is an attachment to be applied to the anvil and piston of a steam hammer, which bends the side bars rapidly into the proper shape and at the same time marks them for drilling.

Mr. E. H. Smith, of Keeler, Mich., has contrived a simple and effective Current Wheel, consisting of a horizontal disk carried by a shaft and having on its under surface a number of hinged buckets provided with bracket stops, the buckets on one side dropping down by the action of the current, while those on the other are automatically folded up against the face of the wheel.

Mr. A. Stoner, of Stony Point, La., has invented a Machine for Separating Yucca Fiber, which is designed for treating the blades of the yucca plant in its green state, so as to separate the fibers mechanically from the green glutinous mass, without exposing them to a rotting or wilting process. It has an endless feed apron, a sprinkling device, revolving mashing rollers, and a series of toothed brushing cylinders working in connection with a metallic plate, over which the fibers pass after leaving the roller.

Mr. G. A. C. Meyer, of Hannibal, Mo., has patented an ingenious Automatic Fan, which is attached to a chair, and is operated by mechanism put in motion by the weight of the person in the chair. A regulating escapement neutralizes the difference in the weight of the persons using the chair. The device is applicable to other light work.

Mr. F. W. Wilson, of Manchester, N. H., has invented a convenient Retort Lifter, for facilitating the operation of setting gas retorts in position in the bench. The lifting device is so constructed that it distributes the strain equally over the whole face of the retort in handling it, which, in view of the brittle nature of the material of which such retorts are made, is an important point.

Mr. E. R. Dingley, of New York city, is the inventor of an improved Automatic Cut-off for steam engines, in which a novel arrangement of mechanism, consisting of a secondary valve chest and its connections, is introduced for the purpose of cutting off steam automatically at each stroke of the piston should the motion of the engine become too rapid, until the engine is slowed down to the proper speed.

An improvement in the Sand Blast apparatus for engraving glass has been patented by Mr. John Whittaker, of Greenpoint, N. Y. The object is to provide an expeditious method of applying the stencils. The inventor uses a curved shield, having either fixed or removable stencils, and adapted to the surface of the ware to be engraved, and having spring handles, by which it is clasped to the ware and by which both are held under the sand blast.

In an improved Railway Car, patented by Messrs. R. L. Dabney, of Hampden Sidney, Va., and C. W. Dabney, Jr., of Emory, Va., the inventors apply timbers alongside the car body, near the bottom, and suspend cross-timbers, on which the car body is supported. The car body is thus hung low, and the upper segments of the wheels are inclosed by boxes projecting above the floor of the car interiorly. Provision is also made for passing around curves with little friction, by supporting the car bodies upon balls placed between them and the side bars of the trucks.

Messrs. Joseph Ogden and Joseph Garrett, of Chester, Pa., have secured a patent upon an improvement in Spinning Mules, which consists in constructing a cop building rail with a double incline, or in attaching to said rail a block having a similar angle. With this double incline the faller arm works in frictional contact, so that when the mule carriage runs in the faller will be caused to "dip" suddenly so as to crosswind the yarn, and thus bind the

regular contacted spiral coils or layers of yarn firmly together.

Mr. Floyd Heavener, of Laramie City, Wyoming Ter., has made certain improvements upon the Car Coupling for which letters patent were granted the same inventor August 28, 1877, the design being to secure greater strength and reduce the wear upon the operating parts.

OUR IRON INDUSTRY.

With no less surprise than interest we note the prominent remedies which in various countries are proposed for restoring the vitality of the iron industry.

While here the two political parties are urging in Congress, the one an increase, and the other a decrease of tariff—each party deriving its opposing arguments and support from the iron manufacturers themselves, the English and French manufacturers are almost unanimous in favor of protective duties, and the government of Belgium has appointed a commission to inquire into the best means of enlarging the field for the consumption of iron, so as to increase the demand for the products of the Belgian works.

Evidently none of these measures would afford more than local and temporary relief; the trouble lies deeper, we think, and is to be reached and remedied only by discovering and adopting new methods and economies in manufacture.

Prominent among the many methods that have been presented to the iron manufacturers in the past ten years are two which with great cost and long experiment have been so far developed that but little apparently remains to be done to perfect them sufficiently for general adoption.

The manufacture of wrought iron directly from the ore—the direct process—and the application of pulverized coal to puddling and heating furnaces, are the two improvements we speak of.

The ideas are old and familiar, but their present improved methods of expression are of recent date, and have had but little publicity, especially among manufacturers on this side of the water.

Though, doubtless, quite as many new points in regard to these processes have been determined here as in England, we are able to obtain from the Reports of the Associations of the English Iron Manufacturers fuller knowledge of the progress made there.

And we would here remark that in these associations, at whose meetings every new process or improvement is fully examined, discussed, and criticised, our English cousins possess great advantages over us. While they act together for their mutual benefit, we act independently of or in opposition to each other, because of jealousies of competitive and sectional interests.

Without dwelling on the worth of Clay, Chênot, and scores of others who have successively added to our knowledge of the manufacture of wrought iron directly from the ore, we come to one of the latest experimenters on the subject—Siemens—who has recently obtained results indicative of a very near approach to a practical and economical solution of the problem through intelligent recognition of the necessity for fine pulverization and ultimate mixtures of the ore and reagents.

In our judgment the failure to recognize the importance of these factors has been the chief cause of the non-success that has accompanied the labors of most experimenters in this direction, for we have long held the opinion that unvarying and satisfactory products and proper economies in time and fuel could in no other way be attained; as only by fine pulverization of the furnace charge can the intimate mixture requisite to prompt and effective chemical reactions be secured.

The only things seemingly now required for the perfection of this process are a furnace of less cost and a manner of firing more simple than that of Siemens, for in the matters of economies in fuel, ore, and reagents, and in character of product, but little remains to be desired.

In the application of puiverized coal to the puddling and heating of iron, Crampton in England, at Woolwich and elsewhere, has achieved fair success by using the Danks revolving furnace; and the most intelligent criticism seems to establish the fact that the method would be completely successful, not only with the revolving but with all other heating and puddling furnaces, were the coal economically reduced to a finer powder.

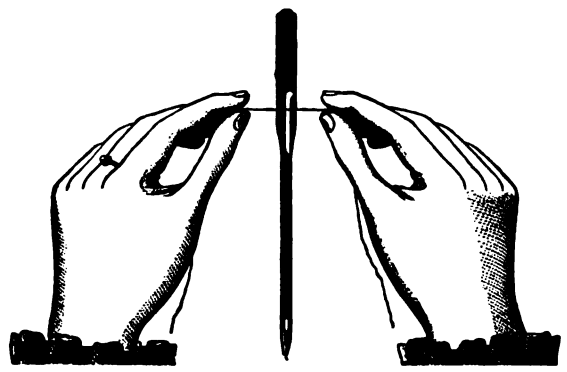
It would therefore appear that the cost of the revolving furnace and auxiliary machinery, and his imperfect yet expensive method of pulverizing, are the only obstacles which retard the general acceptance of Mr. Crampton's process.

Great progress, too, in these directions has been made with us in the past few years, especially toward the point arrived at by Mr. Crampton, so that, judging from the reports from the United States Armory at Springfield, Mass., where a pulverized fuel process has been in operation for several years, but little if any more experiment is required for its perfection. The furnace and the appliances for comminuting and injecting the coal are reported as simple, inexpensive, and durable, and as leaving but little more to be desired.

These two methods, then, which have been of very gradual growth, would seem to offer the iron manufacturer a way out of existing troubles. The manufacturers of iron *per se* must make cheaper and better iron if they would enlarge the field for its consumption, or even if they would hold their own against the steel manufacturers. They must seek new methods of manufacturing rather than changes in tariffs

COMBINATION NEEDLE AND THREAD CUTTER.

The annexed engraving represents a handy little arrangement, which every lady who uses a sewing machine will readily appreciate. It consists simply in forming on the shank of the sewing machine needle a knife edge, by which the thread is divided when pressed against it. Scissors are apt to be mislaid and time lost in searching for them, but with this device, so long as the machine is used, the thread



cutter is constantly at hand. The cutter is of the same fine steel, and receives the fine temper of the needle itself, so that it will retain its edge over an indefinite period. For further particulars address the Domestic Needle Works Company, Middleborough, Mass.

Cotton.

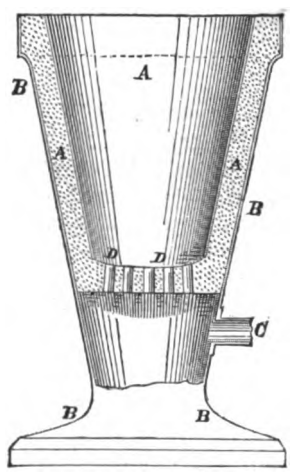
In 1860 the United States took 227,000,000 yards of British cotton goods. In 1877 we took only 61,000,000 yards. In the year first mentioned, Great Britain used half the whole cotton crop of the world; last year she used only 3,017,000 bales, against 8,959,000 bales used elsewhere. English manufacturers explain the relative falling off by the increase of capital elsewhere, and the ability of other nations to cope with them in power of organization; and add that the race will be to the frugal, the industrious, and enduring. They might well have added also the honest; for the credit of English makers has been sadly lowered in the East, and American competition favored, by the excessive adulteration of English goods, aggravated by short measure.

Risky Mining.

Speaking of the terrible explosion at the Haydock colliery, and the appalling frequency of such disasters in British mines, the *Tribune* remarks that these great slaughters do not prove that the skillful inventions and ingenious systems devised to reduce the danger of coal mining are worthless; they indicate rather that for every step of invention there has been a parallel step in taking greater risk. Mines that could not have been worked at all before are now filled with busy laborers, and the chances for loss of life have been little reduced. The frequency of such accidents is a disgrace to the supervision of mining which the British Government undertakes.

A SIMPLE FURNACE.

Mr. M. A. Beck, of Waterloo, Iowa, sends us the annexed sketch of a simple little furnace, well suited for brazing, hardening, and tempering small taps, dies, drills, etc. A is an ordinary flower pot, having a number of small holes, D, drilled in the bottom. B is a frame or casing made of sheet metal, and C is a blast pipe, to be connected with a small blower. The plan might be still further cheapened by setting the flower pot bodily into another one of smaller size, the space between the bottoms then forming the chamber into which the blast is conducted, without materially affecting the result.



Strength of Solar Heat.

Sir John Herschel ("Familiar Lectures on Scientific Subjects," page 64) says: "I have seen the thermometer four inches deep in the sand in South Africa rise to 159° Fah., and have cooked a beefsteak and boiled eggs hard by simple exposure to the sun in a box covered with a frame of window glass and placed in another box so covered."

HONOR TO AMERICAN SCIENCE.—The Huyghens medal of the Society of Sciences, at Haarlem, Holland, a medal awarded once in twenty years to the astronomer who has, during that time, contributed most to science by his discoveries and investigations, has been unanimously given to Professor Simon Newcomb, of Washington, the Superintendent of the Nautical Almanac.

To prevent the hair falling out, the common application, in Oriental countries, is the bruised bulbs of the *Asphodelus bulbosus*, garlic, or onions, mixed with gunpowder. An infusion of the small leaves of the orange or lemon tree in red wine, containing 20 grains of tannin per liter, has also proved serviceable.

Communications.

The Microphone.

To the Editor of the Scientific American:

In *Nature* of May 16th is an article upon the above subject, in which it appears Professor Huxley presented to the Royal Society the microphone as an invention of Professor Hughes, of Kentucky. The device used on that occasion was a glass tube about 2 inches long, fitted with pencils of carbon, through which the battery current was transmitted. Professor Huxley on speaking to this was enabled to transmit words to an ordinary Bell telephone. If Professor Huxley had placed ordinary lead shot in the tube, about number 12, he could have received as well as transmitted by pressing the neck of a common glass funnel to the tube and applying the ear to the cone. We have repeatedly received through such an arrangement, and also by a device arranged on the principle of the Trevelyan rocker; that is to say, we have received without a diaphragm or electro-magnet. As to the wonderful discovery accredited to Professor Hughes, we can only say that we see no need whatever of supposing that "we are beginning to tap sources and modes of energy hitherto undreamed of." nor that the discoveries furnish "a new method of attaching and quantifying molecular motions." Nor is Mr. Edison justified in supposing that he has discovered new and important properties in carbon, for all his results, as well as those of Professor Hughes, can be explained by old and well known causes, which are present in all the experiments published. We have been engaged in investigations on this subject in the same direction as Professor Hughes for the past half year. Many of our experiments are identical with his, and give the same general results. While we agree with him as to facts, we cannot, however, accept his conclusions, nor those of Mr. Edison. All our own experiments, as well as those published by Professor Hughes and Mr. Edison, when closely examined, support us in our conclusion that the effects produced must be ascribed to the well known facts of *contact resistance* at the surfaces of contact between the different parts of a non-continuous conductor. This was in fact the point of departure for all our investigations, and all our experiments were especially arranged so as to determine whether or not this cause is sufficient to produce the required effect (transmission of articulate speech). We succeed not only in transmitting articulate speech where nothing but contact resistance could have been the cause, but also in receiving with some of our contact transmitters, as indicated above. We are still engaged in experiments to determine the conditions under which a conductor containing surfaces of contact can act as telephonic receiver. Now, as contact resistance can be proved to be sufficient to produce all the effects obtained by Professor Hughes and Mr. Edison, and as this element is certainly present in all their experiments so far published, the true and simple logic of science compels us to reject their conclusions until they have obtained the same results after having completely eliminated that element from their experiments. At a future day we expect to give to the public a detailed account of the experiments which have led us to our conclusions.

W. H. PITT,
W. H. DOPP.

Central School Laboratory, Buffalo, June 11, 1878.

The Antiquity of Civilization.—A Query for Professor Newcomb.

To the Editor of the Scientific American:

Under the heading "Planetary Population," in your number for June 1st, 1878, page 346, Professor Newcomb is reported as saying, "The latter (the earth) has probably been revolving in its orbit 10,000,000 years; man has probably existed on it less than 10,000 years; civilization less than 4,000 years." As a student of archæology and anthropology, I would like to ask Professor Newcomb, who being a scientist of some eminence in his line is supposed to know what he is talking about, how and where he obtained the data for these most astonishing figures—especially the two latter (although I imagine paleontologists and geologists would be equally anxious concerning the first).

Under these estimates of time what becomes of the discoveries of Lepsius, Mariette, and others in Egypt, where they declare they have unearthed structures, monuments, tombs, statues, etc., dating back 4,500 to 5,000 years before our era? The deciphering of hieroglyphics, which has attained a high degree of certainty, shows us that nearly, if not quite, 7,000 years have passed since the Fourth King of the First Dynasty built the Pyramid of Cochomé, the first that greets the traveler toward the desert on leaving Cairo. Three thousand years before Solomon built his temple to the "most high" God on Mount Moriah, or the Assyrian reared his altars to Baal on the platform of Koujunjik, Egypt was an old country, her architecture grand and imposing in style and perfect in execution, her language not only fully formed, but reduced to writing, her statuary natural, and her paintings vivid in coloring and truthful in design. I have before me on the table a *fac simile* of the hieroglyphs on the "Gliddon Mummy Case," in the National Museum (*Smithsonian Contributions to Knowledge*, No. 208). Egyptologists are agreed that this case and the writings on it date back to a period antecedent to the reign of Sesorthus or Tosorthus, who flourished B.C. 3,240 to 3,211. Who will look at the exquisite drawing and coloring of this ancient piece of work and be willing to admit that the scribe who executed it was not civilized? nay, that he lived 1,000 years before civilization existed upon earth? And this was already in the fifth dynasty

THE DOUM PALM.

The doum palm (*Hyphæne thebaica*), an illustration of which appears on this page, is remarkable among palms in having branching stems. The trunk is simple when young, but in old trees is forked three or four times, each branch terminating in a tuft of large fan-shaped leaves. The fruit is of about the size of an orange, irregular in shape, with a polished yellowish brown rind, inclosing a single horny seed. The rind, which is dry, fibrous, and mealy, is said to taste somewhat like gingerbread, and is used as food by the Arabs. Although the tree is quite a large one, the trunk itself is seldom over 30 feet high.

OFFICIAL PREJUDICE

General A. A. Humphreys, Chief of Engineers, U.S.A., has recently addressed to the chairman of the House Committee on Levees and Improvements of the Mississippi, an extraordinary letter. The main object appears to be to discredit the work of Captain Eads and to defeat the efforts of that gentleman now being directed toward the more vigorous prosecution of the already successful undertaking. General Humphreys has always been a strong advocate of the Fort St. Philip canal scheme of opening the Mississippi and a non-believer in the efficacy of Captain Eads' plan. But whatever his views may be, they certainly do not justify him in completely shutting his eyes to absolute fact, as he does when he asserts "*that the opinions expressed to the effect that a new bar would form at the sea end of the jetties, and that it would extend into the sea more rapidly than the old bar, are correct, even during the changes going on under the scouring power of the jetties, aided by dredging between and seaward of them.*"

Instead of there being an advance there is an actual recession of the bar, and the jetties have not even been carried out to their projected length, as they are actually more than 200 feet shorter to-day than they were originally intended to be. The deepening has been so marked at the sea ends of the jetties, where the predicted bar growth was to occur, that Captain Eads has not found it necessary to complete them as far out as they were located and partly built two years ago.

Perhaps more inexplicable than any is the assertion, on the part of General Humphreys, to the effect that the "results actually attained at the South Pass disprove the views of Mr. Eads and confirm those of the Engineer Department." The General certainly cannot have read the report of Generals Barnard and Wright, made last January, which, after announcing the presence of a channel nowhere less than 200 feet wide and 22 feet deep, from South Pass, between the jetties, to the deep water of the Gulf of Mexico, says: "This result is so exclusively due to the jetties and auxiliary works that the auxiliary aid of appliances, if in such we include dredging machines, is utterly insignificant." Or if he prefers to ignore these statements of two distinguished officers of his own corps, he certainly must know, as a matter of common notoriety, that the heaviest draught ships are already using the jetty channel.

Captain Eads has published the letter to the Committee of the House, in which he answers General Humphreys' separate allegations in a way which leaves no two opinions concerning either the statements themselves or the motives which prompted them. It is a matter of regret that an officer of General Humphreys' rank and distinguished abilities should permit his prejudices so seriously to warp his better judgment.

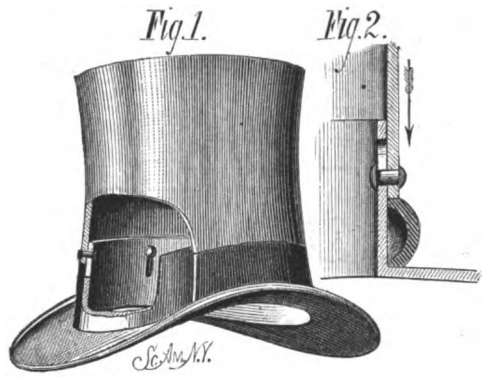
THE CARGO OF THE IDAHO.—The cargo of the lost steamer Idaho furnishes an index of the current contributions of America to the Old World. It comprised 141 packages of agricultural implements; 77,000 pounds of bacon; 98 packages of clocks; 17,311 bushels of corn; 1,904 bales of cotton; 94 bales of hops; 58 horses; 200 tons of fresh meat; 75 tierces of salt meat; 2 cases of machinery; 5 pianos; 12 kegs of printing ink; 25,258 bushels of wheat; 12 packages of manufactured wood.

A NOVEL application of the electric light is proposed by Professor Edison. His plan is to make a diminutive light apparatus, and inclose it in a glass globe of such size as to be easily swallowed. He will connect it with a suitable battery, and he expects to be able to witness the process of digestion, and to see with more or less distinctness the operations of the internal organs.

DON'T SWALLOW CHERRY PITS.—A man died in Vermont the other day, after suffering from dyspepsia for twenty years. Some peculiar circumstances in his case led to a post mortem examination, which revealed thirteen cherry stones imbedded in the lining of the stomach, causing a thickening of the walls of that organ some three fourths of an inch, and ultimately the man's death. It was the opinion of the physicians that the stones had been there many years.

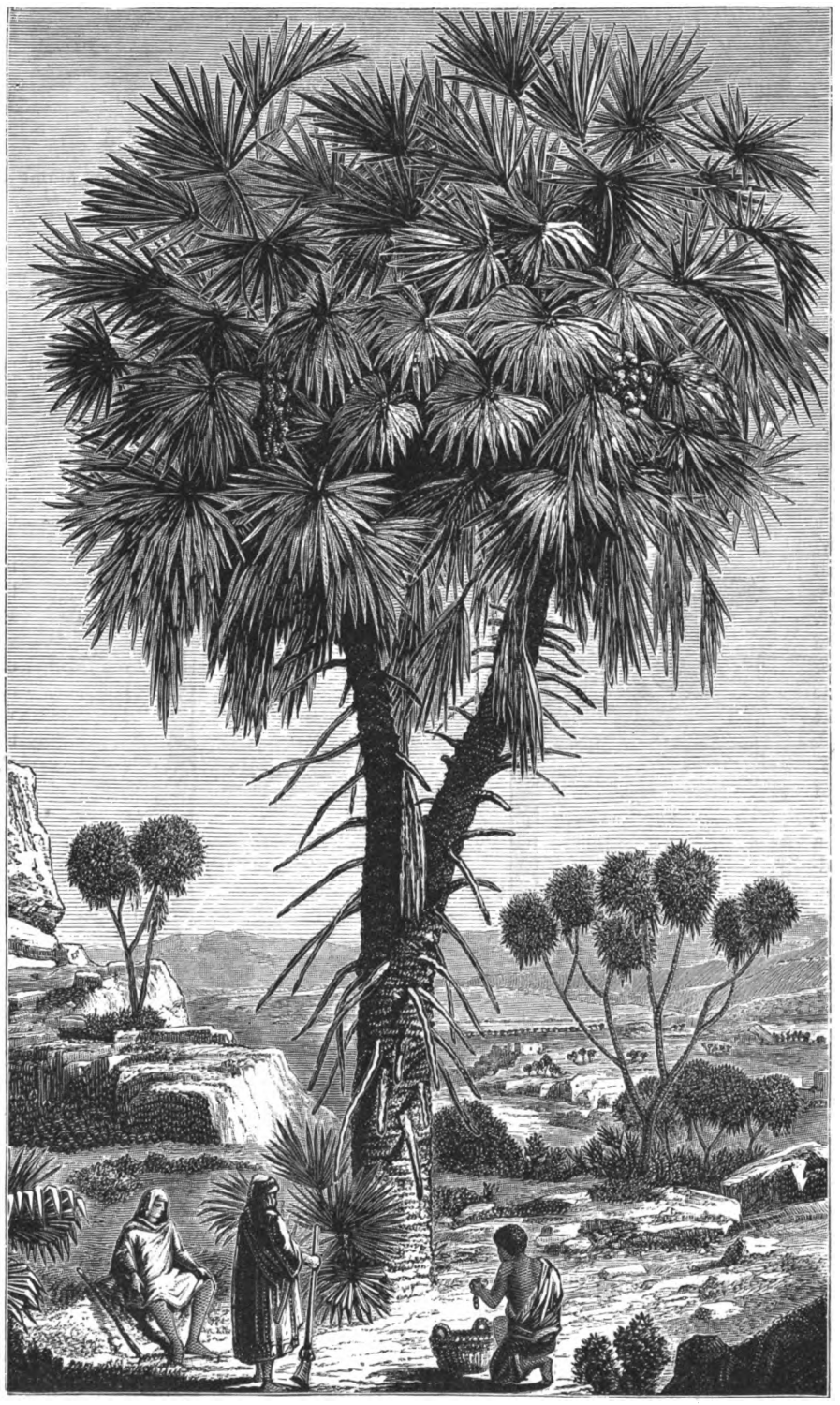
IMPROVED YIELDING HAT.

The annexed engraving represents an improved hat for firemen, policemen, and others, by which the force of falling bodies or of blows may be broken sufficiently to protect the head against injury. The brim is made separate from the hat body, and is provided with a raised portion which is



fitted to the head. The body slides on the rim portion as shown in section, Fig. 2, and is guided by slots and pins, and supported by a cushioning spring. This device was patented through the Scientific American Patent Agency, February 26, 1878, by Mr. José M. de Celis, of New York city.

PROFESSOR EDISON intends to employ his telephone for distinguishing sounds within the thorax and other cavities of the body, in place of the stethoscope. It will be of great advantage in medical schools, as a single telephone will be applied to the subject, and as many receiving instruments as may be required will be placed in communication with it for the use of students.



THE DOUM PALM.

NOTES OF PATENT LAW-DECISIONS OF THE COURTS.

The Atlantic Giant Powder Company brought suits against Goodyear and Townsend for infringement of Nobel's reissued patent, for an explosive compound consisting of a combination of nitro-glycerin with infusorial earth. The question presented on the motion for preliminary injunctions was, whether the pulverulent powder compounded of the usual proportions of nitrate of soda, charcoal, and sulphur, as used in the "Vulcan blasting powder," in combination with nitro-glycerin, was, for the purposes of, and in that combination, the equivalent of "the substance" described in the Nobel patent as possessing "a great absorbent capacity, and which at the same time is free from any quality which will decompose, destroy, or injure the nitro-glycerin, or its explosiveness;" thus, when combined with nitro-glycerin, forming out of the two ingredients "a composition which, without losing the great explosive power of nitro-glycerin, is very much altered as to its explosive and other properties, being far more safe and convenient for transportation, storage, and use than nitro-glycerin."

The preferred form of this substance, as described by Nobel, was the *Rieselgurgh*, or infusorial earth. The substance used by the defendants, in combination with nitro-glycerin, was a mealed powder of nitrate of soda, charcoal, and sulphur, in proportions the same as in some gunpowder in common use in granular form.

It was not contended that the substance itself used by the defendants did not possess, in the combination, every property claimed for the infusorial earth in the dynamite patent, or that the combination of it with nitro-glycerin, as "Vulcan blasting powder," did not possess every attribute and property in a greater or less degree possessed by dynamite.

The contention of the defendants was, that the only object and aim of Nobel's invention, as patented, was to render nitro-glycerin safer in handling and transportation; that there was no intent to augment its explosive force; that, on the contrary, the solid substance exerted no influence and remained as inert matter, while the object of the manufacturer of the Vulcan powder was stated to be "to render the explosion and combustion of gunpowder instantaneous."

It was further argued by the defendants that Nobel in his original letters patent described his absorbent as an "inexplosive" substance, and that if the omission of the term "inexplosive" in the reissue enlarged the scope of the invention, the reissue itself was void; and that if the reissue was to be construed in connection with the original, and for the same invention, it must be limited to the use of absorbents as equivalents which were inexplosive.

The court, however, in disposing of the first objection raised by the defendants, holds that evidently it was not the sole or principal object of the defendants, in manufacturing Vulcan powder, to render the explosion and combustion of gunpowder instantaneous. That if this was the only object of the combination, why begin the process by substituting for the granular gunpowder, so highly explosive, a mealed powder of the same ingredients in a pulverulent state, and of a lower degree of explosiveness than grained powder? The fact was that gunpowder, when used as an absorbent in the Vulcan powder, fulfilled every condition and performed every function of the absorbent in Nobel's patent, besides possessing the additional function, at the time of the explosion, of co-operating, by means of its conversion into gas, with the nitro-glycerin, in rending the rock, instead of remaining, like the infusorial earth, an inert substance. This latter fact, however, rendered it no less an equivalent. The legal reports are full of cases proving that, when a substitute is used for one ingredient in a patented combination which has every property and performs every function of the original in the combination, it does not cease to be an equivalent because, in addition, it does something more and better.

In disposing of the second objection the court holds that the word "inexplosive" was applied in the original patent as a term of description to a substance only preferentially used. The word was used in the original patent to describe substances which, as compared with nitro-glycerin, were inexplosive by concussion, which would not of themselves explode under those conditions which render nitro-glycerin so dangerous and unsafe, and which, inexplosive in themselves under those conditions, when combined with nitro-glycerin, would make the combination a compound which would also be inexplosive except under such conditions as were not inconsistent with substantial safety in its use for blasting and similar purposes. The word was properly omitted in the reissue, not for the purpose of including equivalents which were not

within the scope of the original invention as described, but as an ambiguous expression not consistent with the other words in the specification, which clearly described the absorbent, its properties and functions, all of which properties and functions might appertain to a substance explosive under some conditions, but inexplosive under those conditions which made nitro-glycerin explosive by concussion. The court grants the preliminary injunctions asked, holding that the complainants are not limited to treat as infringements the use of such equivalents only as are actually inexplosive but they are entitled to the exclusive use of such equivalents as are inexplosive as compared with nitro-glycerin, and which, while complying with the other requisites of the infusorial earth in the combination, will also, when combined with nitro-glycerin, form out of the two ingredients a composition which, without losing the great explosive power of nitro-glycerin, is more safe and convenient for transportation, storage, and use than nitro-glycerin.

New Inventions.

Mr. S. P. Cox, of Brooklyn, N. Y., has patented an improved form of Bracelet made of stone, jet, or other material, but especially of stone. It consists in a series of blocks or plates strung upon spring wires, having sufficient elasticity to hold the bracelet upon the arm when the edges of the bracelet are brought together and secured by a fastening similar to a butt hinge. The same inventor has also designed a Locket, so constructed that no metal is visible except the eye or loop to receive the guard.

A new Fire Escape, the invention of Mr. J. S. Shaw, of Joplin, Mo., consists of a folding ladder, made of links and rounds bent of one piece of wire, which is stowed compactly in the hollow sill of a window and suitably secured at its upper end, and is always ready for use.

Mr. Sylvester Snell, of Watertown, N. Y., has patented an improvement upon that form of Animal Trap in which the weight of the animal upon a tilting platform is made to close the doors of the cage. The inventor adds an ingenious mechanical device, operated by the weight of the animal's fore feet, which unceremoniously precipitates him into a pit below.

An improved photographic Camera Shutter, invented by Mr. A. Johnson, of Kewanee, Ill., consists of an interior swinging shutter of novel construction, arranged to shut off the light passing through the camera tube, the object being to provide a means of opening and closing the tube without the knowledge of the sitter.

An improved Thill Coupling, recently patented by Mr. W. L. Wheeler, of Birmingham, Ill., is designed to admit of the thills or pole being readily detached when desired. To the axle is secured a thill clip, having lugs to receive the pin which fastens the irons of the thill or tongue. By means of a pivoted and slotted lever the pin may be easily withdrawn or locked into position by a key forming the outer end of the lever.

Mr. G. L. Reynolds, of Oakland, Cal., has made an improvement in the class of Window Screens, in which the upper and lower wire screens are attached at one end directly to the sashes, so that when the latter are raised or lowered to open them, the screen will be extended over the opening and thus exclude flies, mosquitoes, or other insects without excluding air. The improvement consists in journaling a screen roller in a groove formed in the meeting rail of a sash, and in attaching to said screen roller one balance cord of the journal of the roller and the other balance cord to the sash.

An improved School Desk, patented by Mr. J. P. Pies, of Spades, Ind., belongs to that class of desks which are so made as to be raised or lowered at will. The improvement consists in a new device by which the desk can be readily adjusted and firmly secured in the desired position.

A new Leather Dressing Compound, for boots and shoes, harness, trunks, etc., designed to impart a lustrous black gloss, as well as to preserve and protect the leather, has been patented by Messrs. Norman Quinlan and J. H. Quinlan, Jr., of Glen Falls, N. Y. It is made of shellac, ivory black, alcohol, castor oil, and turpentine in certain proportions.

Mr. J. F. Johnson, of Yocum Station, Va., has made an improvement in Pen Holders, designed to render the pen yielding to pressure upon the point, and to adapt it to be carried in the pocket. It consists in arranging the pen socket in a tubular case, so as to slide freely, with a spiral spring behind the same, which tends to project the pen beyond the tube to its working position, the pen being retracted in the tubular case by means of a stud extending through a longitudinal slot in the said case, and secured by being turned axially into a notch.

Mr. David Healy of Los Angeles, Cal., has patented a Waste Trap designed to prevent the escape of sewer gas, to prevent siphoning, and to supply hot and cold water to a basin through concealed pipes. It has two water seals arranged in a peculiar manner, and a float valve which when subjected to suction adheres more closely to its seat, thus preventing the removal of water from the trap.

An improved Blackboard arrangement has been invented by Mr. H. W. Eastman, of Baltimore, Md., in which the blackboard proper is pivoted in a frame, in which it slides up and down, so that it may be reversed in position to bring either side to the front. The special point consists in balancing the blackboard by means of a sliding frame adapted for holding alphabetical or arithmetical tablets, said board and tablet frame being connected by ropes which pass over pulleys at the top of the fixed frame, in which the movable parts slide vertically; the arrangement being such that the blackboard is prevented from turning on its pivots when the tablet holder is lowered into the required position behind it.

An improved Buckle for harness, which may be disengaged from the strap or trace in connection with which it is used, without the necessity of drawing upon the strap or trace to release the buckle tongue, has been patented by Mr. R. J. S. Graham, of 79 Murray street, New York city (care of Edward A. Boyd). It has an open frame, which may be drawn together or spread apart by an adjusting screw, and has a movable bar which hooks over the sides of the frame when the buckle is in use, but is released, so as to liberate the buckle tongue by turning the adjusting screw.

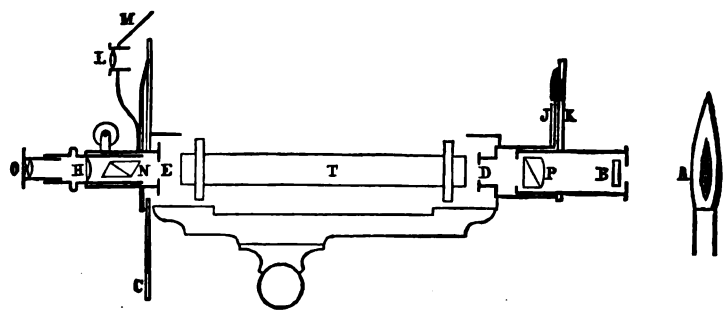


Fig. 1.—SACCHAROMETER IN SECTION.

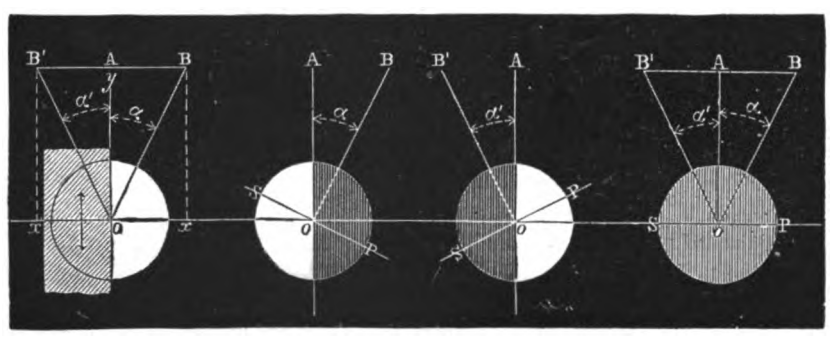
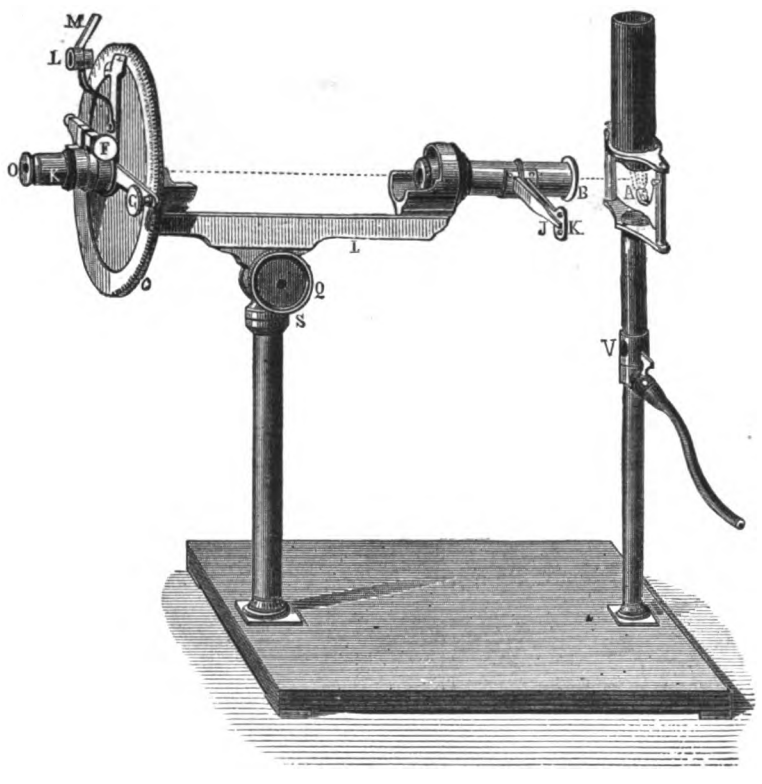


Fig. 2. Fig. 3. Fig. 4. Fig 5



THE NEW LAURENT SACCHAROMETER.

Mr. J. W. McGarrett, Jr., of Nashua, N. H., has devised a movable Copy Holder for children when learning to write, the advantage of which is that the copy may be moved down the page as the writing progresses, so that the learner may always have his copy before him, instead of using the line last written as a copy for the next. The holder is made of tin, wood, or other suitable material, and has flanges upon its edges to receive the copy slip, and feet which support it at the right inclination.

THE NEW LAURENT SACCHAROMETER.

We are indebted to *La Nature* for the annexed illustrations of an improved saccharometer, by which, it is stated, observations of unusual accuracy may be made. The apparatus is represented in longitudinal section in Fig. 1. A is a yellow monochromatic flame, placed at an invariable distance from the instrument. The burner is constructed so as largely to augment the intensity of the flame. B is a diaphragm containing a plate of bichromate of potash, which absorbs the violet and blue rays which exist in the flame, while allowing the useful yellow rays to pass. P is a bi-refracting prism, in which the second image is diverged to one side and intercepted by diaphragms. It turns on the axis, O E. D is a diaphragm carrying a thin plate of quartz parallel to the axis, the thickness of which is one half wave for the yellow rays. This is fixed and covers but the half of the diaphragm. E is another diaphragm; N, the analyzing Nicol; H, the objective; O, concave eye piece. The system, O H N, is mounted on an alidade, which turns on the disk, C, around the axis, O E. T is the tube containing the solution to be tested. C is a graduated disk having one or two divisions; one especially for sugar, the other in half degrees of the circle for any rotary substances. L is a lens for reading the scale. M is a mirror throwing the light of the burner on the divisions and thus obviating the need of any additional light. The new optical disposition consists in the polarizing system, which is composed of two distinct parts—the bi-refracting prism, P, which turns, and the diaphragm, D, which with its half plate of quartz is fixed. In Fig. 2 this diaphragm is represented enlarged, as it is seen on looking into the instrument. The left half is covered by the quartz plate, the axis of which is also parallel to the line of separation, O A, and the right half being open allows of the passage without deviation of the polarized light from the polarizer, P, Fig. 1.

Let it first be supposed that the plane of polarization is parallel to O A. If this be left fixed and the analyzer, N, be turned, there will be a progressive passage from total extinction to maximum illumination, and the two halves of the disk will always remain equal to each other in intensity exactly as if the quartz plate did not exist. The plate being always fixed, let the polarizer be turned so that the principal section comes at O B, making with the axis, O A, any angle, a. Let a vibration occur in the plane represented by O B. This vibration, represented in length by O B, may be decomposed into two others—one, O Y, parallel to the axis, O A, of the plate, and the other, O X, perpendicular. This vibration will pass without deviation on the right side, but on the left it will be deviated by the plate. The ordinate, O Y, being parallel to the axis of the quartz will not change sign, but the abscissa, O X, which is perpendicular thereto, will change sign, and will come to O X′ at 180°, since the plate is a half wave in thickness; so that at the left side the vibration resulting will occur in the plane, O B′, making with O A an angle, a', symmetrical and equal to a. This plate therefore has for its object to determine at the left side a principal section, O B′, placed with relation to the line of separation, O A, symmetrically to the principal section, O B, on the right side. If the polarizer be left fixed in this position, and the analyzer be turned so as to render the principal section, S P, perpendicular to O B, Fig. 3, there will be total extinction at the right side, but partial at the left side, as shown. Reciprocally, if the principal section, S P, of the analyzer is perpendicular to O A (Fig. 4) there will be total extinction on the left and only partial on the right side. Finally, if the section, S P, be perpendicular to O A (Fig. 5) there will be partial extinction for both sides and equality of tone, since $a = a'$.

If the analyzer be left fixed in this last position, and the polarizer be turned so that the principal section makes with O A angles varying from 0° to 45°, the two semi-disks will always remain relatively equal in intensity, but together will change their common intensity, passing from complete extinction to maximum illumination. In other words, if the apparatus is regulated at zero—that is to say, at the equality of tones—and if the polarizer be turned while their relative intensity will not be changed, their common one will pass through all degrees.

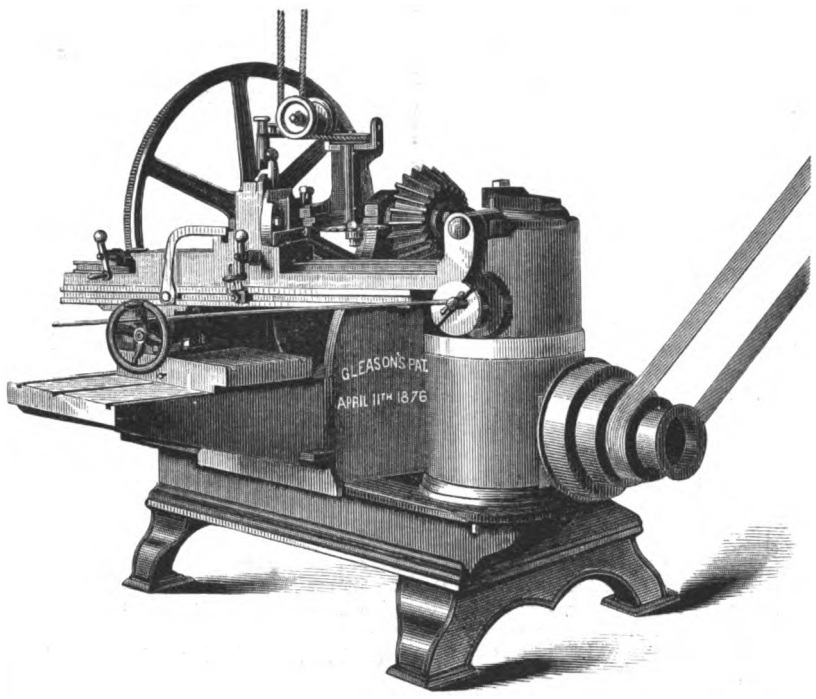
If, however, after causing the polarizer to make any angle whatever with O A, and leaving it fixed in this position, the analyzer be turned over a small angle in either direction from S P, Fig. 5, then the equality of tones in the two semi-disks is at once broken, and one becomes dark and the other light. This sudden change allows of the determination, with great precision, of the position of the analyzer; that is, of the zero of the instrument when no substance is interposed. If by interposing a substance possessing rotary power the equality of tones is destroyed, it is necessary to turn the analyzer until this equality is re-established, and the angle over which the analyzer is moved shows the rotary power of the substance.

PATENT GEAR-DRESSING MACHINE

We illustrate herewith a new machine for dressing teeth of gear wheels, either of iron or wood, or made bevel or spur. To bevel wheels it is claimed to give a perfect reducing cut, making the small end of the cog the same proportionate shape as the large end. The motion is transmitted to the tool block by a central shaft, permitting the radial bar that carries the tool to be swung to any angle from 0° to 90°. It is also hinged, so as to permit of a vertical movement. The form is placed under the bar, and by moving it to or from the center, wheels of different pitch can be planed with the same form.

To dress spur gears, the head is moved crosswise on the frame, the bar is swung to 0°, or parallel to the spindle on which the gear is chucked, the form is placed under the tool holder, and the latter is fed over it. To dress wood gears and patterns, a bracket, which holds a thick circular saw, is held in the tool post; it is driven from a radial countershaft overhead, receiving a quick rotary motion and reciprocating at the same time. It is fed over forms the same as if planing iron, only much quicker, as the saw cuts both ways, the feed being continuous.

The machine is constructed so as to plane the smallest pinion as well as wheels of the full capacity. The gear to be planed is chucked on the overhanging end of a spindle and on the other end is the index wheel, which is accurately spaced. The head which carries the spindle can be moved to or from the center of radial bar, for the purpose of adjusting the gears to be planed, so that the radial lines terminate at the proper point. The end of the radial bar is laid out in degrees. On a wheel that the angle on pitch line is 60°, by planing the pinion on 30° it will, it is claimed, be perfect. Any imperfections of patterns or turning lathe are corrected in the dressing. In dressing wood gears the turning of the face and ends is done in the planer and at the same time that the teeth are shaped.



GLEASON'S GEAR-DRESSING MACHINE.

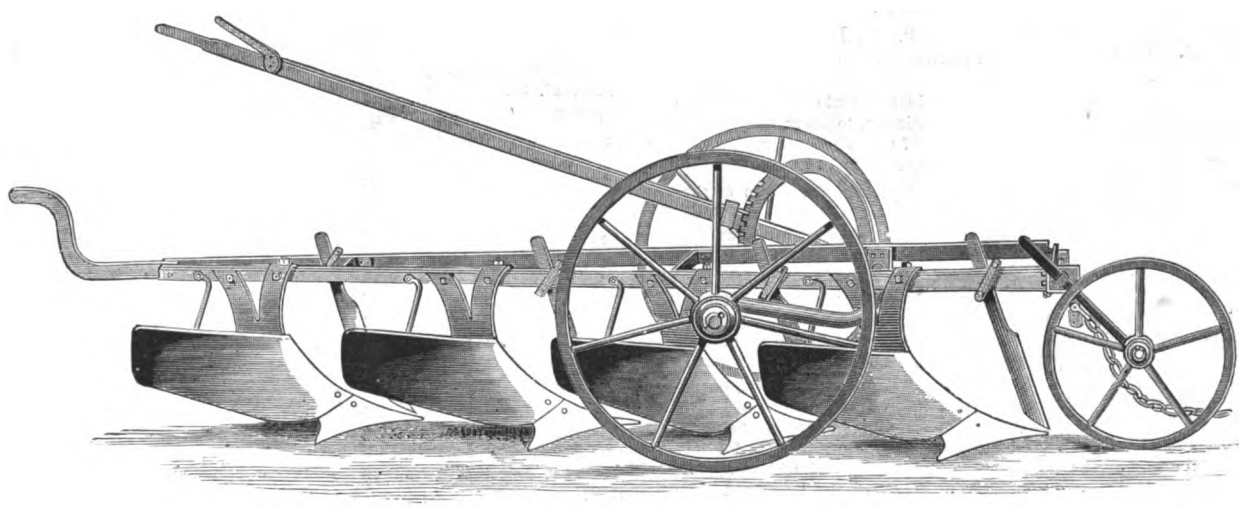
For further particulars address the manufacturer, Mr. William Gleason, Brown's Race, Rochester, N. Y.

Atmospheric Absorption of Solar Forces.

M. Marchand states that during the vertical passage of the sun's rays through the atmosphere, they are despoiled of 74 per cent of the chemical power which they possessed at the moment when they reached the outer boundary of the aerial ocean. According to the experiments of Bouguet, Pouillet, and others, under the same conditions the rays lose 13 per cent in illuminating and calorific power, so that it would appear that the calorific and chemical influences of light are absorbed by the atmosphere under very different conditions.

AN IMPROVED GANG PLOW.

The implement shown in the accompanying illustration is one of the new quadruple gang plows manufactured by Messrs. Howard & Co., of Bedford, England, who are manufacturers of convertible plows. It combines the functions of two or three plows in one, and is adjustable for a variety of work, the parts being constructed with a view to removal or alteration in arrangement at short notice. As a gang plow many advantages are claimed for it, principal among which are lightness, facility of repair, and the readiness with which the depth of the plowing may be regulated. The latter is effected by the long lever as the implement proceeds, without stopping the team, and at land's end the same lever lifts the four plows clear of the ground to facilitate turning. In this and other respects it resembles the better type of gang plows made in this country, and it is especially intended for the rapid shallow plowing which is preferred in the West. The manufacturers designed it, we believe, for the East India market.



HOWARD'S GANG PLOW.

A ROYAL STREET CAR.—A handsome car is being built in this city for the use of Dom Pedro in his trips between his country seat and his palace in Rio Janeiro. It is about the size of an ordinary car, but, owing to its elaborate fittings, will cost about three times as much. Special devices are introduced to insure perfect ventilation. The same firm are also building a lot of cars for the Finsbury Tramway of London. They are provided with top seats, which are self-closing by means of a spring.

Telephone Improvements.

M. Maiche states in *Les Mondes* that he has succeeded in suppressing the peculiar metallic quality imparted to the voice transmitted through the telephone by substituting for the metallic diaphragm a rubber membrane about 0·4 inch in diameter by 0·04 inch in thickness, to the center of which a disk of tinned iron of the same thickness and about 0·1 inch less in diameter is attached. In face of the magnet the rubber is exposed, over an area a little larger than that of the face (we infer from M. Maiche's description that this transforms the disk into a ring), and the membrane is brought to within 0·04 of an inch of the magnet. M. Maiche claims in this way to realize two apparently antagonistic conditions, namely: 1. A thickness of iron sufficient to react on the magnet with sufficient energy, and to develop sufficiently intense induced currents; 2. A vibratory sensibility, which allows of the reception of very weak sounds. The voice heard, moreover, is identically similar to that of the speaker talking over a distance of a few yards. There is no alteration in timbre, and all the characteristic qualities are preserved.

M. Maiche has also found that long magnets, some 16 inches in length, on which wire was wound over a third of their extent with few coils, are much more sensitive than short magnets. The distance to which sound may be transmitted depends principally on the size and length of the magnet coil and on the section of the conductors. A copper wire, 0·4 inch in diameter and 8 inches long, making four or five turns around the magnetized bar, suffices to transmit the sound over a distance of several yards. The membrane of the transmitting instrument M. Maiche considers should be much larger than that of the receiver. The first should be from 3·2 to 4 inches in diameter; the second reaches its maximum sensitiveness at diameters between 1·2 and 1·6 inch.

The Marginal Shield-Fern as a Tæniacide.

Mr. C. H. Cressler communicates to the current number of the *American Journal of Pharmacy* the result of some experiments made by him to test the efficacy of the marginal shield-fern (*Aspidium marginale*) in the expulsion of the tape-worm. He was led to make these trials through the failure, on a certain occasion, of an emulsion of the oleoresin of the imported male fern (*A. filix mas.*,) to effect satisfactory results. As might have been expected from species so nearly allied, he found the constituents of the former to be identical with those of the male fern, and its efficiency to be fully equal. The marginal shield-fern is one of our most widely distributed species of the North, is very common in all of our woods, and, being an evergreen, may be collected at any season of the year. Most of the male fern for medicinal use has hitherto been imported, although the plant is found northward in the region of Lake Superior, and westward. Mr. Cressler's experiments were made with the oleoresin obtained from the rhizome of the fresh plant, and administered in gelatine capsules.

POISONOUS LEGUMINOUS PLANTS.

Leguminous plants, on account of the great abundance of albuminous material, in addition to starch, found in their seeds, have always been considered the equals of the most nutritious cereals—such as wheat, etc.—as articles of food. Of such plants the common bean has probably been largest known and is most widely distributed. It was cultivated by the Jews, and considered as sacred by the Greeks and Romans. A temple to the God of Beans, *Kyanetes*, stood upon the sacred road to Eleusis; and the *Kyanepsia*, or bean feast, which the Athenians celebrated in honor of Apollo, was characterized by the use of these legumes. To the Egyptians the bean was an impure fruit, and they did not venture to touch it. The black speck on the white wings of the flowers was formerly looked upon as the written character of death; for which reason the bean in ancient times passed as the symbol of death. It has been reserved for modern times to learn that "death" may indeed "lurk in the pot" with at least some of these hitherto unsuspected pod-fruited plants. Attention has been called to the fact by Dr. Rothroch that certain leguminous plants growing in our Southwestern Territories possess poisonous properties. In the vicinity of Fort Garland, in Colorado, cattle have quite often given evidence of poisoning, which on investigation has been traced to the plant *Oxytropis lamberti*. The effects that follow the eating of this plant appear to be long enduring, the animal becoming demented and wasting away as its fondness increases to something like the opium habit in man. Dr. Rothroch detected at New Camp Grant, Arizona, another plant, *Hosackia purshiana*, the effects of which are similar to the preceding. According to the *Academy*, Professor Cohn has recently reported a case of the poisoning of hundreds of sheep, at Namslau, from eating *Lupinus*. Two circumstances were spoken of as probable causes. Professor Cohn had, a year previously, demonstrated the existence in *Lupinus* of an active bitter principle, of which the poisonous properties, closely allied to the poisonous alkaloid of the water hemlock, are established. The other possible cause was found to be the occurrence, in most of the specimens submitted, of sclerotia, which burst out in the form of small black warts closely arranged in parallel series. Professor Cohn remarked that the question as to whether the poisoning should be attributed to the lupine or the fungus must be settled by chemical investigation. Subsequent experiments, however, in cultivating the fungus from the sclerotium have not as yet led to the production of any specific form that could have produced the poisoning. The lupines grow wild throughout the whole of Europe and in India and Arabia, and are mostly used as food for cattle, although the seeds are sometimes used by the poorer class of people. America has also its lupine (*Lupinus perennis*), and its bitter seeds are eaten from Canada to Florida. Another poisonous leguminous plant proves to be *Sophora speciosa*, from Texas. From the seeds of this Dr. H. C. Wood, Jr., has extracted an alkaloid which he calls *Sophoria*. The effects of this are stated to resemble those of the calabar bean. The seeds are used by the Indians of Texas to induce an intoxication which lasts from two to three days. Half a bean will, it is said, cause intoxication, and a whole one may be productive of dangerous symptoms. As to the alkaloid, Dr. Wood states that three grains of it hypodermically failed to very seriously affect a dog, but killed a cat in a short time.

The Coming Wheat Crop.

The harvest began in Missouri May 20, fully a month before the usual time. By the first of June the harvest season opened in Southern Illinois. The crop is magnificent throughout the entire country, and promises to be the largest ever gathered. The yield is estimated as high as 500,000,000 bushels. The movement of breadstuffs Eastward of late has been unprecedented.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

THE ROAD MASTER'S ASSISTANT AND SECTION MASTER'S GUIDE. By W. S. Huntington. Revised and enlarged by Charles Latimer. Published by the *Railroad Gazette*, 73 Broadway, New York city.

This is a valuable treatise on a branch of railroad work about which not much has been written, and yet upon which the safety and economical management of railway lines very largely depend. The best feature of the book is that it avoids technicalities and addresses itself directly to the practical side of its subject. It begins with track laying, and takes up in order the topics of laying the rails, spiking, construction of cattle guards, culverts, etc., ballasting, elevation of curves, track repairs, frogs, and switches, etc. The volume is clearly written, and contains numerous good illustrations.

UPLAND GAME BIRDS AND WATER FOWL OF THE UNITED STATES. By A. Pope, Jr. Published by Scribner, Armstrong & Co., New York city.

We have already directed attention to this magnificent work, the sixth part of which, recently issued, is now before us. The present number contains two splendidly executed water color facsimiles of paintings of the Canada Grouse and the Wood Duck, together with the descriptive letter press. Both as a work of art and as a contribution to the literature relating to the natural history of the country, this collection of plates will be of lasting value.

DETERIORATION AND RACE EDUCATION. By Samuel Royce. Edward O. Jenkins, Publisher, 20 North William street, New York.

The author thinks that the race is deteriorating. He holds that society, and the means of preventing ever present morbid tendencies from settling into abnormal and anti-social formations, must be the chief study of the future teacher; and that the great work of the latter is the application of physical, mental, and social hygiene to the physical, mental, and social degeneracy as manifested by an excessive rate of mortality, insanity, pauperism, and crime. The work is well written, and abounds in illustrative facts and instances, together with much useful statistical information gathered from a wide range of literature.

STUDIES IN LUKE. S. R. Wells, Publisher, 737 Broadway, New York. Price 60 cents.

This is the original Greek text of the Gospel, and an interlined literal translation, together with illustrative foot notes, appendix of weights, coins, names, phrases, and other explanatory matter.

We have received Reports and Awards of the Centennial Exposition, covering Groups 28 to 36 inclusive. As a maximum average we suppose that about half the contents of this voluminous series of reports has some utility; the remainder, being simply lists of the premium winners, is of no value perceptible to us. It may be of interest for John Smith to read that his production is "commended for excellence of design, beauty of finish," etc., and perhaps, if very few exhibitors in common with him attained like commendation, the general public might find therein a useful guide as to the relative importance and merit of the various exhibits; but as several thousand contributors come in for like encomiums, this portion of the work will be appreciated chiefly as showing how rich the language is in commendatory adjectives. We have already noted several good reports in the series, and to this list we can now add those of the Judges on Educational Exhibits and on Horological Apparatus.

Notes & Queries

(1) J. L. asks: What is a good way to case-harden iron links and blocks for locomotives? A. Heat the metal to redness, sprinkle prussiate of potash upon it, and plunge into cold water.

(2) "Subscriber" writes: In making soda water, what is the best practical proportion of sulphuric acid to marble dust? A. Mathew recommends 3 lbs. of marble to 5 pints of sulphuric acid.

(3) F. A. L. asks: How can I remove the black color caused by rubbing a match against the side of an ornamental bright brass match box? A. Use a little moistened emery on a soft cloth; or first apply strong hot potash solution to the parts, wash this off with water, then moisten with nitric acid, rub with sawdust or a soft cloth and water, dry, and relacquer. Dilute alcoholic shellac solution colored with dragon's blood and turmeric is the lacquer generally used.

(4) H. P. writes: Last fall I bottled some cider, "curing" it with sulphite of lime and mustard seed. At present the most of it lacks life, although an occasional bottle has sufficient carbonic acid gas to give an agreeable taste. Can you suggest a way to enliven the dead cider? A. Add about 30 grains of bicarbonate of soda and one third that quantity of citric acid to each bottle, stopper securely, and invert for a time.

(5) C. B. T. asks: What is a good and cheap substitute for linseed oil in making putty? A. Menhaden and cotton seed oils have been used, either alone or mixed with a little linseed oil.

(6) C. R. P writes: By leaving the key of a telegraph instrument open, thus breaking the circuit, does the liquid in the battery cease to operate on the amalgamated zinc? A. The battery fluid does not entirely cease to act on the zinc and mercury. These metals would in time be gradually dissolved, even if the electric circuit were kept open. It would then be said that the "negative" was dissolved by "local action."

(7) T. A. T. asks: What is the speed of a perpendicular fall of water of 100 ft. at a temperature of 4° Celsius? A. About 2½ seconds.

(8) C. W. B. writes: Recently an artisan in this town dissolved a quantity of gold (coin and old jewelry) by the aid of nitro-muriatic acid. From the solution he threw down a precipitate with aqua ammonia. This precipitate was placed on a filter and allowed to drain dry, but not washed. The precipitate and containing filter paper were then placed in a crucible with carbonate of soda and carbonate of potash. The crucible was then placed on a forge, and, when heat was raised, an explosion took place great enough to shatter the crucible and scatter its pieces and the fire of the forge to all parts of the shop. What was the cause? A. A large part of the precipitate formed by the addition of ammonia to the gold solution consisted of ammonium aurate or fulminating gold ($Au_2O_3 4NH_3OH_2$), a very explosive compound; we do not wonder at the result.

(9) F. C. C. asks for a simple mode of testing the inflammability of coal oil. A. In a small cup or glass place a quantity of the oil to be tested, and immerse in the oil the bulb of a good thermometer; suspend the cup containing the oil in a vessel of water and gradually heat the water; move about close to the surface of the oil a lighted taper, and note the degree on the thermometer at which the oil begins to emit inflammable vapor (the flashing point), and again that at which the oil inflames. Oil to be used in lamps should not take fire below 115° Fah. In applying the lighted taper the flame must be kept away from the glass of the thermometer.

(10) J. S. asks: How are the different cuts of files denominated? For instance, what constitutes "bastard cut," "second cut," etc.? A. Bastard cut is a little finer than a rough file. Second cut is still finer than a bastard; then comes smooth, superfine smooth, and dead smooth.

(11) J. P. asks: What is the chemical composition of the "Pharaoh's serpents?" A. The light solid matter composing the "serpent" consists of mellone, melam, and mercuric sulphide; the substance from which it is evolved (the "egg") is mercuric sulphocyanate—the precipitate obtained by the addition of mercuric nitrate to solution of ammonium or other alkaline sulphocyanate, washed and dried.

(12) T. R. S. asks: Is there any process by which strong or rancid butter can be cleansed and restored to its original condition? A. Rancid butter may be improved by working it over with fresh cream; also by digesting it for a short time in a melted state with a quantity of fresh, granular animal charcoal, free from dust, and after straining thoroughly, reworking. See p. 102, vol. 36.

(13) I. H. T. writes: Suppose a block of ice with a thermometer imbedded in it in a temperature 10° above zero. Will the thermometer go to zero if the ice be placed in an atmosphere of zero? In other words, does the temperature of ice vary? A. The temperature of ice varies with the temperature of surrounding objects below 32° Fah.; the thermometer would register 0°, provided the conditions remained constant long enough.

(14) P. M. B. asks: Can a ⅝ inch round rod of iron, say 60 feet long, secured at each end of a building with a nut and washer, with no support in the center, be drawn taut enough to sustain from 400 to 500 lbs., to be carried along the same by a car, without bending? A. It cannot be made to carry any weight whatever without some deflection. You will find rules for amount of deflection in works on the strength of materials.

(15) M. C. asks: What is meant by the internal grooving and pitting of boiler plate? A. Grooving is the formation of channels in the iron, and pitting is the formation of little depressions of dish form made in the iron at various places.

(16) W. M. B. writes: I have frequently noticed during a storm that the thunder which succeeds a flash of lightning sometimes commences far off towards the horizon, and gradually increases in intensity until it ends in a loud burst nearly over our heads. As the discharge is accomplished in an instant almost, why is it that we hear the thunder from a distance first sometimes? A. The following explanation, from "The American Cyclopedia," may be satisfactory to you: "This sound may be prolonged, as it is reflected in echoes by the clouds; or, as suggested by Sir John Herschel, it may come in successive impulses to the ear, as brought from an instantaneous discharge that extends for miles along a line directed away from the observer. So the terrific sudden crash may be the result of a flash occurring all around the observer, with no great difference of distance from him in the points of the discharge."

(17) J. C. W. asks: Would an iron railing or cresting on the roof of a building increase the danger from lightning? A. No. The iron railing would assist in protecting the building if it were connected with a rod well grounded in the earth.

(18) G. H. C. asks: Can black oxide of manganese be dissolved so as to produce a jet black liquid suitable for an ink? I have made a solution in hydrochloric acid, which produces a brownish green liquid? A. None of the manganese salts form solutions suitable for inks. Strong aqueous solution of potassium permanganate forms purplish red ink, which flows readily from a pen and soon turns brownish black.

(19) J. W. B. asks: 1. What pressure per square inch is necessary to reduce or compress atmospheric air of common density, inclosed in an airtight cylinder, to one half, one fourth, and one eighth its volume? A. If the temperature of the air is maintained constant during the compression, the pressure varies inversely as the volume. 2. What are the advantages claimed for hydraulic elevators over steam ones? A. The motion of the hydraulic elevators is claimed to be smoother and more free from jars.

(20) S. R. S. asks: How can I harden brass wire which has been softened? I have tried slow cooling in stove and in ashes, but without success. A. By rolling or hammering it cold.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. A. P.—The dextrin is of good quality. It contains a very little starch and a trace of glutinous and saccharine matters. Use hot water and do not add too much of the dextrin flour at a time.—H. O. T.—No. 1 is colophonite and black garnet in pyroxene; apparently also zircon. No. 2 is coccolite and wollastonite with garnets and a small quantity of pyrites and mispickel. No. 3 is mostly actinolite—a variety of hornblende.

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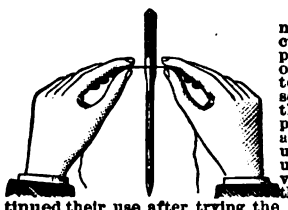

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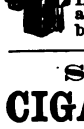

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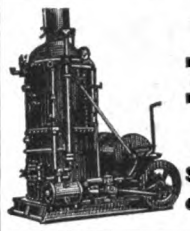

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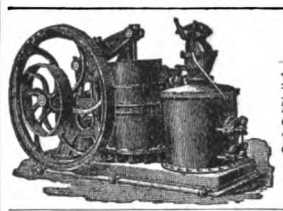

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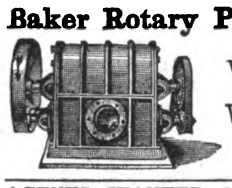

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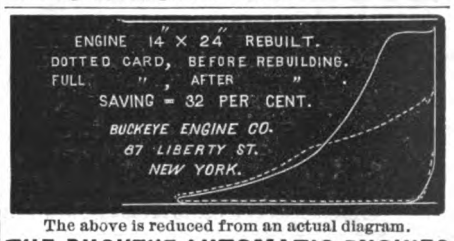

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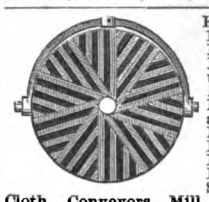

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